THE GEOGRAPHICAL JOURNAL

Vol CXIX Part 4 December 1953

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NOTICES

PROGRAMME OF MEETINGS

JANUARY – MARCH 1954

Friday January 1 *at* 3 *p.m.*
THE ASCENT OF EVEREST AND ITS SIGNIFICANCE. *By T. D. Bourdillon and C. W. F. Noyce. Joint meeting with the Geographical Association and the Institute of British Geographers.*

Monday January 11 *at* 8.15 *p.m.*
AMONG THE TRIBES OF VENEZUELA AND COLOMBIA. *By Ross Salmon.*

Friday January 15 *at* 5 *p.m.*
METHODS OF AIR AND SURFACE NAVIGATION. *By Wing-Commander E. W. Anderson and others. A meeting of the Institute of Navigation.*

Monday January 18 *at* 5 *p.m.*
A NEW BRITISH STEREOSCOPIC PLOTTING INSTRUMENT FOR AERIAL PHOTOGRAPHS. *By Professor E. H. Thompson. A joint meeting with the Photogrammetric Society.*

Monday January 25 *at* 5.30 *p.m.*
LAND OF THE LONG DAY. *Kodachrome sound films of Eskimo life.*

Monday February 1 *at* 8.15 *p.m.*
SEVEN YEARS IN TIBET. *By Heinrich Harrer.*

Monday February 8 *at* 5 *p.m.*
AIDS TO THE DOMESDAY GEOGRAPHY OF N. W. HEREFORD. *By Lord Rennell of Rodd.*

Monday February 15 *at* 5.30 *p.m.*
BOLIVIAN FIESTAS. *Colour films with commentary by Baroness Fain.*

Monday February 22 *at* 8.15 *p.m.* (*provisional*).
BETWEEN THE OXUS AND THE INDUS. *By Professor K. de B. Codrington*

Monday March 8 *at* 5.30 *p.m.* (*provisional*).
ALASKAN ICE FIELD. *Colour films with commentary by Maynard M. Miller.*

Monday March 15 *at* 8.15 *p.m.*
THE PERSIAN GULF STATES AND THEIR BOUNDARY PROBLEMS. *By Lieutenant-Colonel Sir Rupert Hay.*

Monday March 22 *at* 5 *p.m.*
OXFORD UNIVERSITY EXPEDITION TO UGANDA. *By J. F. M. Middleton.*

Light refreshments will be served after Evening Meetings to Fellows, Associate Members and their guests.

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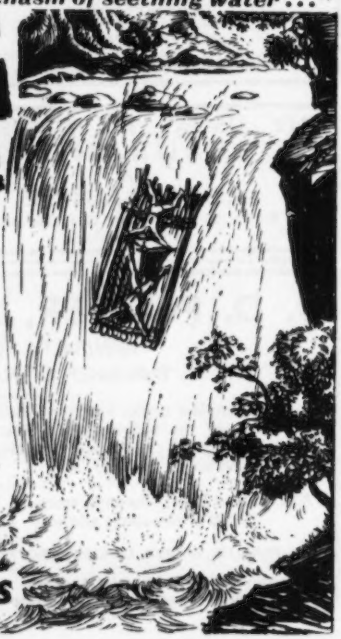

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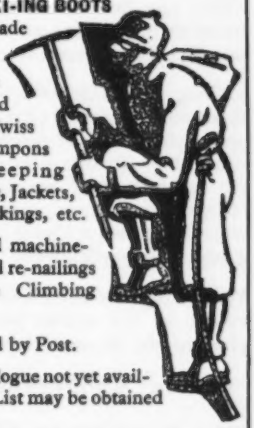

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BW/12/53

Her Majesty The Queen with Brigadier Sir John Hunt, looking at equipment before the film "The Conquest of Everest"

The
GEOGRAPHICAL JOURNAL

Vol CXIX Part 4 *December 1953*

THE ASCENT OF MOUNT EVEREST

BRIGADIER SIR JOHN HUNT AND SIR EDMUND HILLARY

Her Majesty the Queen, Patron of the Society, His Royal Highness the Duke of Edinburgh, Her Royal Highness the Duchess of Kent, Honorary President of the Society, and Her Royal Highness the Duchess of Gloucester, were graciously pleased to be present at a meeting held at the Royal Festival Hall, London, on the afternoon of 2 November 1953. This meeting, as well as one on September 14 at the Royal Festival Hall and another on October 19 at the Central Hall, Westminster, was attended by Fellows and members of the Royal Geographical Society, members of the Alpine Club and many distinguished guests.

The paper that follows is based on the illustrated lectures delivered on these occasions by Brigadier Sir John Hunt, Sir Edmund Hillary and other members of the British Mount Everest Expedition 1953, under the auspices of the Joint Himalayan Committee of the Royal Geographical Society and the Alpine Club.

IN DESCRIBING the ascent of Everest, I must first of all recall that this is a story which has been going on for nearly thirty-three years; there have been no less than eleven major expeditions to Everest since 1921, eight of them, including this year's expedition, sent out by the Royal Geographical Society and the Alpine Club, acting jointly as the Himalayan (formerly Mount Everest) Committee. Not all of these were serious attempts to climb the mountain, for the problems encountered were so numerous and difficult and the chances so limited by the weather, that three whole seasons were spent during these thirty odd years in preparing the way for an attempt planned to take place the following year. This happened in 1921, 1935 and again in 1951 after the war.

To put our own expedition in its right perspective, therefore, it must be realized that a great deal had already been done to pave the way. Not only had our predecessors brought to light most of the problems and found the answers to many of them, but they had also actually climbed to a very great height on different flanks of the mountain—about 28,000 feet was attained by Norton and Somervell as early as 1924, and again in 1933 by Smythe, Wyn Harris and Wager, on the northern side; the Swiss guide Lambert and the Sherpa leader Tenzing reached approximately the same height on the southern side in 1952. It was our task and opportunity to complete an

adventure—I might almost say a mission—which had already been lived and told almost to its end by many gallant men before us.

Organizing a big expedition is a formidable business. We started to get ready in September 1952, about five months before we were due to leave this country for Nepal, and in many ways this was far too late; we were working against time throughout the preparatory period. We tried out the most critical items of clothing, equipment and food on a high pass in Switzerland in mid-winter and made trials of the oxygen equipment on our own hills in North Wales.

One of the lessons of the past was the need to become thoroughly accustomed to a high altitude before attempting any of the bigger Himalayan peaks and the only way to ensure this was to go out to the Himalaya some time before the period when we planned to climb Everest, and to carry out a programme of acclimatization training among the lower mountains. The period when the weather seemed most likely to give us a chance on Everest was after mid-May, when the winter gales and the extreme cold should have abated, and the arrival of the monsoon some time after June 1. There was no certainty that we should be lucky enough to have a fine weather gap, but we aimed to be absolutely ready from May 15 onwards. To do so, and at the same time have a period of preliminary training, meant leaving for India and Nepal in the middle of February.

On February 12 the main party left Tilbury by sea while a small advance party set off a few days later by air to pave the way. We were a party of thirteen: Charles Evans, Tom Bourdillon, Michael Westmacott, George Band, Wilfred Noyce, Charles Wylie, Edmund Hillary, George Lowe, Alfred Gregory and myself. Dr. Michael Ward came as expedition doctor, Dr. Griffith Pugh was the physiologist[1] and Tom Stobart was the cameraman. All but two of the team had been to the Himalaya before.

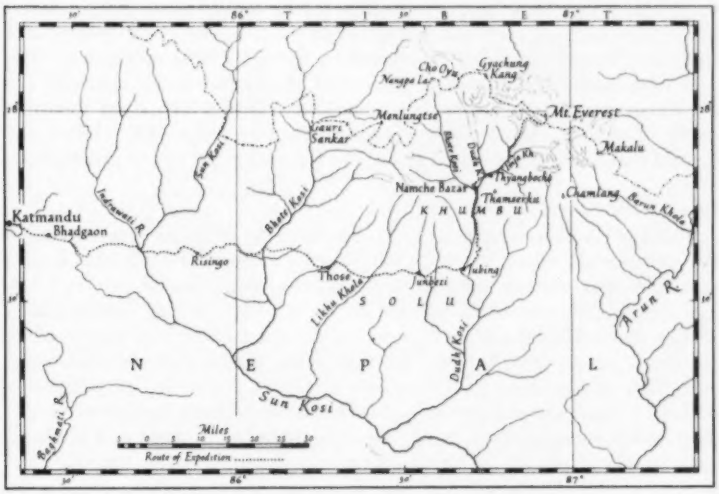
The expedition assembled at the British Embassy at Katmandu the capital town of Nepal. It was from here that we were to travel on foot to the mountain, a journey which would take us seventeen days. We had with us no less than $7\frac{1}{2}$ tons of baggage made up into man-loads each weighing about 60 lb. This meant a small army of carriers, or coolies—about 350 of them. So numerous were we at the moment of leaving Katmandu, that I decided we must travel in two convoys at a day's interval.

During our stay at Katmandu those other full members of the expedition, the Sherpas, arrived under their great leader Tenzing. We had arranged for twenty of these splendid little men to do the most arduous carrying on the higher part of the climb, and here most of them were, smiling and gaily coloured in their odd assortment of clothing from the various expeditions they had served on, ready for this biggest expedition of all. Tenzing himself made up the climbing party to a total of eleven. Only a few months earlier he had come back from his second expedition to Everest in a year with the Swiss, and it was uncertain whether he was fit enough to go again. But from the moment we met there was no further doubt about this—he was obviously going to go high.

[1] His attachment was made possible through a generous grant from the Council of the Royal Society.

We were to march eastwards from Katmandu for about 150 miles, moving roughly parallel with the main range of the Himalaya. This had the disadvantage that we would be going athwart the grain of the land, crossing ridges and climbing thousands of feet in and out of deep valleys. But this was more than made up for by the variety and excitement of the scenery and by the fact that such a march was in itself an excellent way of getting fit for the job.

We had a wonderful journey through the beautiful land of Nepal. During the early part of the march the hills were gentle, broad and richly cultivated, just what we needed in our then unfit condition to run us in gradually for higher and steeper ground. The weather was perfect and it was still cool among those lower hills; some of the early flowers were out—almond blossom



The route from Katmandu to Mount Everest

in the cultivated areas, rhododendrons, magnolias in the higher forests and primulas along the paths. Breasting the ridges we had tantalizing views of the high mountains on our left, towards the north. We went down and down the flanks of the ridges to the foaming torrents, crossing them sometimes by log bridges close to the turbulent suface of the water; sometimes by a high swinging suspension bridge of chains and planks. The marches were short, owing to the slow progress of our laden coolies, and we had time to bathe as we waited for our cook Thondup to prepare breakfast. As the days passed, the country became first alpine, then more truly Himalayan in appearance; the hillsides were steeper and rocky, covered in places by virgin forest; we began to catch glimpses of the snow mountains, now challenging in their nearness. We had turned northwards up the deep glen of the Dudh Kosi, making directly towards our goal; and just before we reached our first base camp we sighted Everest itself.

On March 26 we arrived at the monastery of Thyangboche. Situated at over 12,000 feet on a high ridge, it must be one of the most beautiful places in the world. Here we set up a base camp for the next three weeks, while we trained among the surrounding peaks. The camp was on a grassy alp in constant view of the Everest group. We paid off the coolies who had carried our loads and got our kit ready for the next task—acclimatization. For three days we discussed plans and attended lessons in the use of our equipment, and then set out in several parties for the training period. We climbed six peaks of about 20,000 feet, got to know the country and one another, and became accustomed to our equipment, especially the oxygen.

It was now about mid-April and we had to move up the Khumbu valley to reach the foot of Everest, where we planned to set up a second base camp high up on the Khumbu glacier. The various parties moved there independently in the third week of April, moving up beside the Khumbu glacier which takes its source from Everest and dominated by Everest's close neighbours. The new base camp was situated at just under 18,000 feet in the centre of the glacier surrounded by fantastic ice pinnacles, above which stood the great peaks—Lingtren, Pumori, Nuptse and others. One party under Hillary had arrived there before the others to explore the lower part of the mountain.

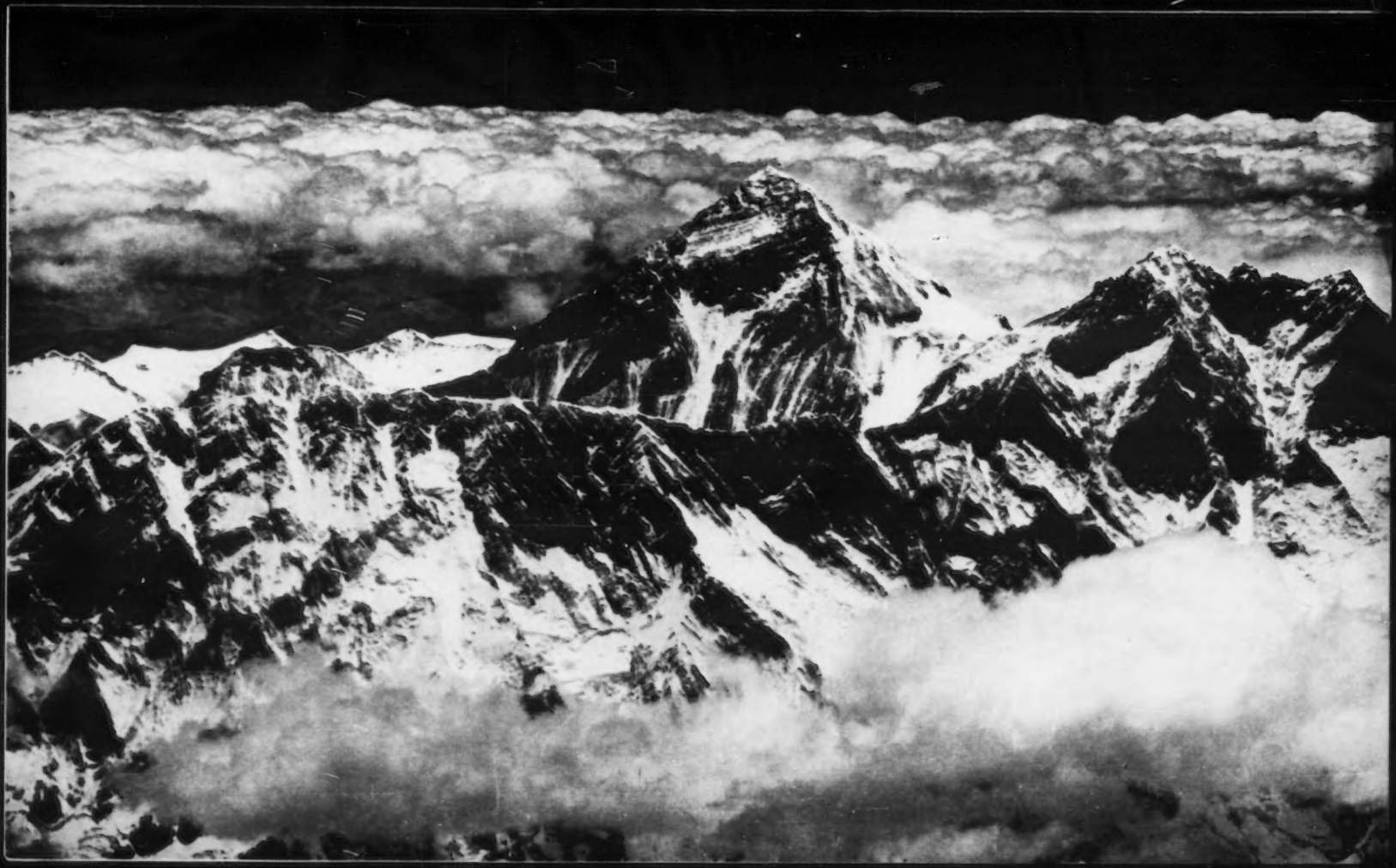
Into the West Cwm

The first problem in getting up Everest from the Nepalese side is to climb the great Icefall, which descends steeply over a height of 2000 feet. It presents a serious obstacle from the technical climbing point of view and it is also a constant source of danger, for the ice is always shifting downwards in sudden unpredictable surface changes. Great chasms open up, masses of ice are poised at one moment and the next come crashing down, obliterating everything in their track of destruction, and it is a maze through which it is difficult to trace a practicable way. The Icefall leads into a long narrow high-level valley running down from the final walls of Everest and enclosed both by our mountain and two others which complete the trinity of the Everest group—Lhotse (27,890 feet) at the head of this valley, and Nuptse (25,680 feet) on the side opposite Everest. The valley itself is known as the Western Cwm. The average height of its floor is 21,000 feet and it slopes gradually downwards towards the sudden drop of the Icefall.

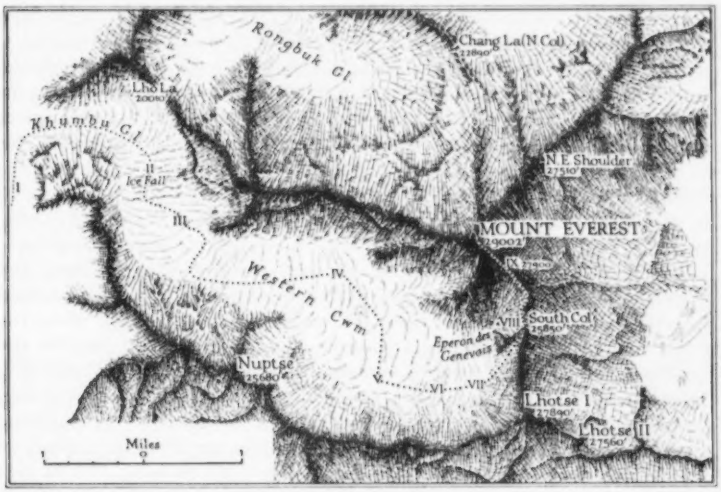
Before we could make an attempt on the summit we had to shift the great bulk of our stores higher up the mountain and closer to its final keep; we planned to establish an advance base camp high up in this Western Cwm at over 21,000 feet. First a way must be found up the labyrinth of the Icefall and farther along the Cwm to the site chosen for the advance base. Then over 3 tons of stores must be carried (in smaller loads of about 40 lb now, owing to the greater height and the difficulties of the climbing), staging at various camps yet to be set up, by teams of Sherpas led by members of the climbing party.

We had now increased the Sherpa team to thirty-four by recruiting and equipping local men from Khumbu and the work of stockpiling in the Western Cwm started according to plan on April 24—it will be remembered that it was to be finished by May 15. We worked on two levels; one party

Everest from the south beyond the Lhotse-Nuptse wall
Photo: Indian Air Force



from Base Camp, the other from Camp III at the top of the Icefall at over 20,000 feet. The work became a regular system of ferries, working almost to a time schedule. The low-level teams would leave Base Camp about midday and reach Camp II about half-way up the Icefall two or three hours later. There they stayed for the night and, starting early, would reach Camp III at the entrance to the Cwm by 9 or 10 o'clock. They dumped their loads at Camp III and descended directly to base in the early afternoon, ready for the same programme next day. The high-level parties would take over the burdens dumped by the Icefall Sherpas, carry them up to the site for the future advance base—at first only a dump for these stores and later labelled Camp IV—and return down the Cwm to Camp III in the course of a long, hard day. The climbing in the Icefall was always strenuous and difficult;



The Western Cwm

there were bridges to cross, ladders to climb, vertical ice walls to ascend in steps carved in the ice, with the aid of a hand line or rope ladder. There was always the danger of falls of ice at a moment when a carrying party was underneath some tottering ice cliff. Falls were constantly occurring and it was mainly chance (perhaps indeed a miracle) that we were spared any accident throughout the many weeks that we moved up and down the Icefall. The weather was bad. For five weeks it snowed during a part of every day, covering the laboriously prepared track with deep new snow, making each journey a fresh problem in track making and route finding and it was all the more depressing in that we were so intent on being ready from mid-May onwards. Our numbers were reduced too by sickness; many suffered from sore throats and hacking coughs, and there were numerous cases of tummy troubles.

But the work, though slowed down, went steadily ahead, and everyone took

View down the North face of Everest, taken by Hillary from the summit, showing the North Col, North Peak, Rongbuk Glacier (left), East Rongbuk Glacier (right) and Rongbuk Valley

a cheerful, full and effective part in this process of getting ourselves ready for the assault. The stores at Base Camp dwindled; at Camp III they piled up only to be whittled down as they were shifted daily farther up the Cwm to Camp IV.

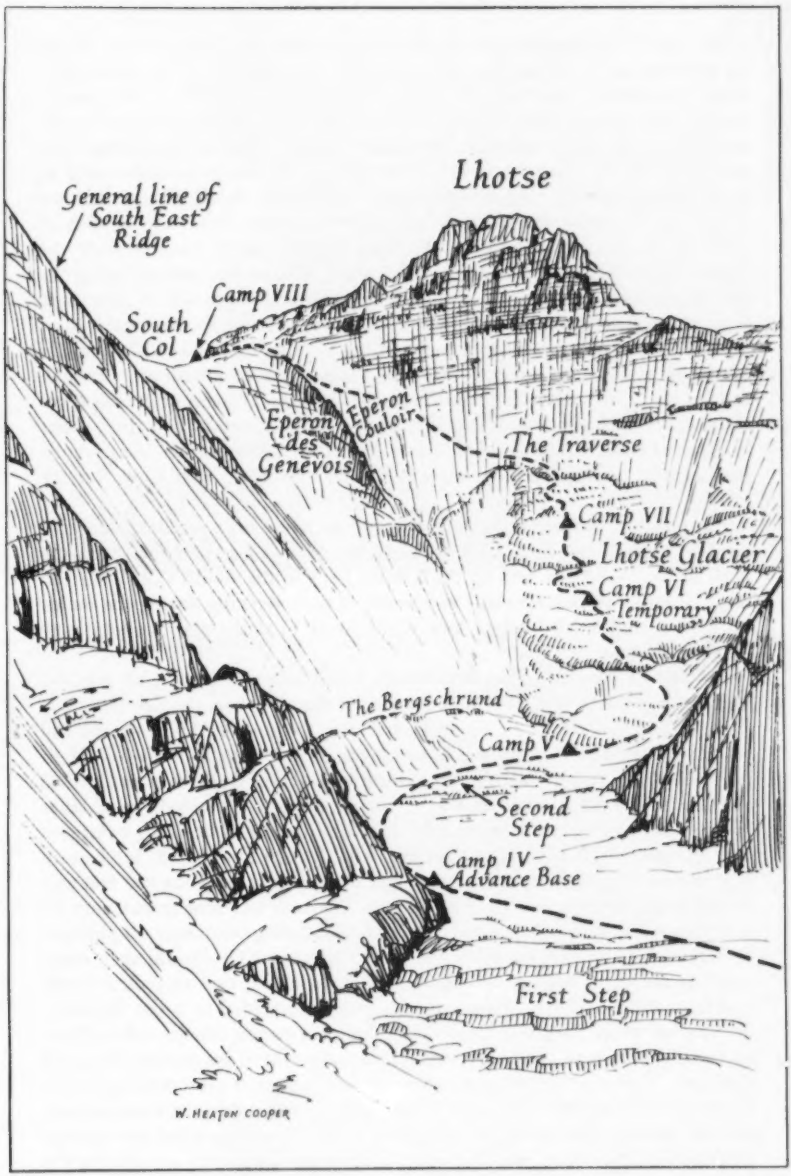
Up the Lhotse Face

During all this time, of course, we were spying out the land ahead. Reconnaissances had preceded the making of the route through the Icefall: likewise we had sent a party up the Western Cwm at the beginning of the build-up period in order to prepare a way to and look for a site for Advance Base. Now, about half-way through the three weeks' period of stockpiling, the most important reconnaissance of all was carried out: the way out of the Western Cwm. This, the Lhotse Face, is the crux of the whole climb. It is 4000 feet high, it is uniformly steep and it is technically difficult—a glaciated slope with vertical cliffs or steps of ice separated by snow-covered shelves—and the problem of climbing it is made infinitely more severe by the altitude, for it rises from 22,000 feet at the head of the Cwm to nearly 26,000 feet on the South Col. First we sent a small party to find a way and also to experiment with our oxygen equipment for the first time at really high altitude, for hitherto we had been able to try it out only below 20,000 feet during the training period. As a result of this reconnaissance, which was carried through in appalling weather conditions by Evans, Bourdillon, Ward and Wylie, another party was sent up to prepare a route through the main difficulties—Lowe, Band and Westmacott with a special party of Sherpas. Band and Westmacott fell sick at the beginning of this important mission and Lowe had to carry on with the Sherpas alone. He set up a tent on a ledge where the Swiss had camped the previous autumn at about 23,000 feet and for ten gruelling days he, assisted during various stages by a magnificent Sherpa Ang Nyima, and by Noyce and Ward, remained on the Lhotse Face, operating between 23,000 and nearly 25,000 feet, without the aid of oxygen; cutting steps in the steep ice, fixing ropes to assist parties on the most precipitous ground, stamping a trail through the deep snow on the terraces. For the first five days his work, like that of the toilers lower down, was hampered by heavy snowfall; and at times the Lhotse Face team were waist deep in fresh snow. Yet by May 20, they had forced a route nearly two-thirds of the way up the Face, and over the main difficulties. It was a performance which will go down in the annals of mountaineering history.

While this was going on, others of us were carrying the stores ever higher, from Camp IV to the very foot of the Lhotse Face; from there the special items required for the assault plan were lifted up the Lhotse Face in the track prepared by Lowe's party, first to the temporary Camp VI then, as he progressed, to a Camp VII at 24,000 feet. Thus we infiltrated up the mountain.

We had made a rough guess at an assault plan in London, but it was only after the reconnaissance of the Lhotse Face that a definite scheme could be made, based on actual experience of the ground, the weather conditions and the performance of our equipment. On May 6 I was able to make the final decisions, which were as follows:—

We would be prepared to make, if necessary, three attempts on the summit



Reproduced from "The Ascent of Everest" by John Hunt (London : Hodder and Stoughton, Ltd., 1953)

Route up the Lhotse Face to the South Col

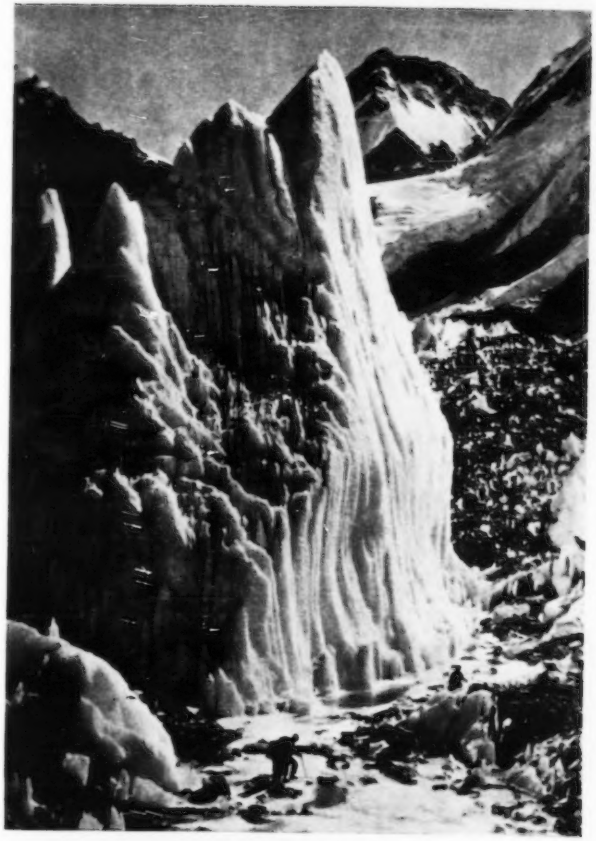
—this much was feasible in terms of men and material. Two of these would be made in quick succession, the one supporting the other, on consecutive days if the weather allowed. Each assault party should consist of two men to attempt the summit, and others to accompany them, in support so to speak, and carrying stores to establish the highest camp of all, the final camp from which the attempt would be made. The first assault was to be made using an experimental type of oxygen equipment—the closed circuit type—which we hoped would enable us to save time, effort and (not least) the burden of additional oxygen cylinders, by climbing directly to the summit from the South Col without the use of a further camp. The second assault, using the more fully proven open circuit equipment, would be made if necessary from this top camp. Bourdillon and Evans were to make the first attempt on 'closed circuit,' supported by myself and two of our élite band of Sherpas, Da Namgyal and Ang Tenzing. We had, during the acclimatization period, trained seven of the best men in the use of oxygen. The second attempt was to be made by Hillary and Tenzing, supported by Gregory and three other Sherpas of the select team—Ang Tema, Pemba and Ang Nyima. Ang Nyima had already established a reputation by his fine work with Lowe on the Lhotse Face.

But before these first two attempts could be made over 700 lb of stores—oxygen, tents, food, fuel, cookers, climbing gear—must be lifted from the head of the Western Cwm up the Lhotse Face to the South Col. Fourteen more Sherpas, chosen specially as a result of their showing during the build-up period, and led by Noyce and Wylie, were to undertake this vital preliminary mission.

It was now May 21. Two days before I had sent off Noyce with the first party of eight men to Camp V at the foot of the Face and the day following (May 20) he had reached Camp VII, half way to the Col. Wylie's party had started off for Camp V on this same day and was due to go up to VII in Noyce's tracks—twenty-four hours behind him. It was an anxious and critical day in the history of the expedition, for everything depended on whether Noyce's party would in fact get up to the Col; they would be doing so largely over ground which we had not yet explored, let alone prepared, for Lowe's magnificent effort had at last petered out on the 20th below 25,000 feet and he had come down for a badly needed rest. We were watching from Camp IV a certain point on that immense backcloth of dazzling whiteness—a pinnacle or sérac of ice which concealed the tents of Camp VII. Would they come out? At about 10 o'clock two figures emerged alone, two tiny dots barely visible to the naked eye. Apparently, Noyce had decided to adopt the alternative plan which we had discussed, of taking his leading Sherpa—Annullu—and making the track upwards while leaving the rest of his men in the camp that day. This was disappointing, for it meant a serious overcrowding in the few tents of Camp VII that night when Wylie's party would also have arrived, and the lurking uncertainty remained as to why the others had not accompanied him? Were they sick or too tired, and if so would they go on even the following day? We waited and watched throughout that day, our anxieties banished by wonder and admiration, as Noyce and Annullu climbed steadily up those steep slopes to the top of the glaciated incline and turned across

The Expedition passing through Badgaon, with Noyce (right)

In the Dudh Kosi



Ice pinnacle on the Khumbu glacier

Bridging a crevasse in the Icefall

Wylie and Sherpas on the Lhotse Face

Evans (left) and Bourdillon on return from the first assault when they reached the South Summit (28,720 feet)

towards the South Col itself. Soon after 2 p.m. we caught a last glimpse of him, a speck of blue against some rocks, and then he disappeared beyond the crest of the Col. It was a triumphant moment. For twelve days now we had been doing battle with this, the greatest obstacle of all on our way to the top —and now it was overcome. As we watched Noyce on his epoch-making climb, we also saw Wylie and his nine men arrive at Camp VII. The watchers at Advance Base settled into their tents for the night, excited by the drama of that day but carrying their anxieties to bed with them—for the big question still remained, would the complete party of fourteen men with their leaders follow Noyce's lead and go up to the Col next day?

And on May 22 we again stared at the Lhotse Face. Despite the possibly grave consequences to the assault plan I had sent Tenzing and Hillary up to Camp VII the day before to give encouragement to the Sherpas in their vital mission and support, if it were needed, to Wylie and Noyce, and we watched in amazement as a whole string of seventeen little dots spread out across that great white expanse, creeping gradually—with painful slowness but moving none the less—in Noyce's footsteps of the day before. As the day wore on, it became obvious that they were going to make it and at long last I was able to put an end to the anxiety and suspense by deciding that the assault should start.

The first assault: Evans and Bourdillon

The weather, having done its best to deter us for five weeks, had suddenly turned fine on May 14, just the day before we had planned to be ready to seize any opportunity we might be given. It had succeeded in delaying our readiness for a week, but miraculously—I can give no other explanation— the elements continued to smile upon our struggle. Bourdillon, Evans, Da Namgyal, Ang Tenzing and myself went up to Camp V on the evening of May 22, meeting there on arrival some of the most stalwart of the men who had made this possible by carrying loads to the distant Col that day. Among them were Hillary and Tenzing, who, having left Camp IV only the day before, had climbed to the South Col and were now on their way back to Advance Base from 21,200 to 26,000 feet and back in thirty hours—not only this, but they must now get ready to follow us in the second assault. These facts speak eloquently of the guts and stamina of these two men.

Using oxygen though we now were, we found it a long, hard climb to the South Col. We spent a restless and anxious night at Camp VII, with the great west wind sweeping across the Face of Lhotse in tremendous gusts which buffeted the tents and seemed intent on uprooting us bodily, tents and all, down the mountainside. We struggled on upwards next day (May 24) heavily burdened and slowed down by the tiresome breakable crust formed on the snow surface by the wind; no traces remained of the large party which had climbed these slopes only two days before. At about 4 p.m. we at last climbed out of the couloir and stood on the top of the Geneva Spur gazing down at the South Col of Everest, a dismal enough scene. We were also looking for the first time at the final keep of the fortress of Everest, the last 3000 feet of the mountain. This was an awe-inspiring but scarcely encouraging sight. A tall slender snow peak, the South Summit (28,720 feet), rose

The Western Cwm and Lhotse (centre)

directly above our heads, incredibly close yet somehow depressingly far above; leading to it was the ridge by which we must climb, running down to the south-east, its angle gentle in places but surprisingly steep in others. To reach it was not going to be easy, for we must climb by one of several steep snowfilled gullies in the South Face, which rises above the Col for over 1000 feet. The peak was clear, but a great plume of snow dust was as though appended to it—a banner of cloud which is an almost permanent feature of the mountain.

To reach the surface of the Col you have to descend a slope of some 200 feet, so down we went, with the uncomfortable feeling of going into a trap, for this slope, gentle and innocent as it was, must again be climbed to get back to our comrades and safety, at 26,000 feet and very weary, after making our attempt on the summit. It was a dreary, dread scene. There were the tattered remnants of the Swiss tents set up there last autumn, the bare skeletons of them, all but a few shreds of canvas stripped from them by the westerly wind. Around were scattered remains of equipment, a bleached climbing rope, oxygen frames, odd tins of food. A more comforting sight was the mound of stores carefully weighted down with boulders, which had been carried up for the assault. We dragged out two tents, and set to work to put them up. For the next hour and more we were engaged in a struggle which none of us will ever forget. We were trying to put up just one of those two small tents, fighting with the wind, an invisible enemy which pulled the canvas from our hands and made our task all but impossible. Weak as we were after our climb, deprived now of oxygen, we were hopelessly inadequate for the job. We tripped over the ropes, fell over stones, got in each other's way. In the end the tent was up somehow, just before we became completely exhausted and the sun went down. We scrambled in and, amid a confusion of gear, settled down, utterly weary, for the night.

It had been blowing hard during the night; but the morning of May 25 was not only brilliantly clear, the infamous north-west wind, which had so nearly prevented us from getting into our tents, had died away to a stiff breeze: conditions were as favourable for an assault on the summit as they ever can be on Everest. But we quickly decided that we must wait for another day before essaying it. It will be remembered that Evans and Bourdillon were to make their attempt directly from the Col and for this an early start was essential. We had been far too tired the night before to get ready—and getting ready at 26,000 feet is a slow and exhausting business. There remained much to be done, particularly in preparing our oxygen equipment. Moreover, one of the two Sherpas who were to help me in getting a part of the stores for the highest Camp (IX) up on the south-east ridge was in a bad state of exhaustion and we still hoped he might recover with rest. Despite the drawbacks—a possible turn of the wind or weather against us; using up food and fuel not allowed for in the plan; the risk of our own physical deterioration—we stayed through that day on the Col, resting and getting ready for the morrow. On the 26th after some delay and much anxiety over the functioning of the oxygen equipment, both parties set out—Evans and Bourdillon as summit party and Da Namgyal and I as support party. Ang Tenzing was still sick and we two were fairly heavily laden with a tent, fuel,

food, in addition to our own oxygen sets and personal equipment—about 45 lb each. The two 'summiters,' with their more powerful oxygen soon pulled ahead of Da Namgyal and myself, as we followed very slowly in their tracks up the snow gully we had chosen to lead us to the south-east ridge. Near the top, the angle of the snow steepened uncomfortably and we had to move away on to a slope of rock and snow on the right. A little higher the slope eased suddenly and we found ourselves beside another pathetic relic of the Swiss Expedition: the frame of a small tent just below the ridge, where Tenzing and Lambert had spent a terrible night without sleeping bags almost exactly a year before, during their splendid effort to reach the top. Here we lay to rest and recover from the ordeal of that climb up the gully, fighting and gasping for air for a while; in my case, though I did not realize it at the time, there was a blockage of ice in the tube of my oxygen set which must have added very considerably to the pain and grief of that day's climb. We were both pretty tired by now but decided to struggle on up the ridge as long as we could. Being short of one of our carrying team I had realized that we should probably not be able to lift the stores for the top camp as high as I had planned—I had always intended to place it much higher than any camp established on Everest before and hoped that this might be at 28,000 feet. Now, without Ang Tenzing, it seemed that the best we could do would be to dump the stores and leave the second assault party with their three Sherpas under Gregory, to carry them still higher. Before leaving, I looked round at the view—on the world, in fact, for we were now climbing on its roof. There was Lhotse, for all its 27,800 odd feet not very much higher than we. Away on the western horizon rose another Himalayan giant Kangchenjunga, third highest in the world, only 800 feet lower than Everest itself. We must have climbed on for another half hour or perhaps a bit more (it seemed an eternity) until we found a niche in the crest of the ridge where the loads could safely be placed. Here we built a cairn—the height we now reckon to have been 27,350 feet—and leaving our oxygen bottles for Hillary and Tenzing we started down towards the Swiss camp. Even going downhill now seemed a very great effort; every step had to be carefully considered for we were moving on steep ground and a slip would have been serious. We moved one at a time down the couloir, each safeguarding the other with the rope passed over his ice-axe; as we went down, I was relieved to see figures spread out across the great slopes of the Lhotse Face on their way up to the Col. This was of course the second assault party, who had started forty-eight hours after us because of the exhausting feat of Tenzing and Hillary in accompanying the Sherpas to the South Col only a few days before. Here they were, fitting perfectly into the timing of our own attempt. We were both well-nigh at the end of our tether when we reached the level ice surface of the South Col, and without the wonderful help of Hillary and Tenzing, who had got up ahead of the rest of their party, I doubt whether I should have had the strength to crawl back to the tents.

Meanwhile Evans and Bourdillon were climbing strongly and steadily up the south-east ridge—I had last seen them in a break in the clouds—some 300 feet above us, while we rested near the Swiss tent. But those of us who were now gathering on the Col below could not know this, for the weather

was by no means good; it was once again blowing hard and the whole of the upper part of the mountain was obscured by cloud.

It might have been half an hour after Da Namgyal and I had got back—I was resting, I remember, in a tent and chatting with Tenzing—when George Lowe shoved his head in through the narrow entrance. He was wildly excited—jubilant. "They're up!" he shouted, "By God they're up!" Everyone was overcome with excitement. The Sherpas, believing the slender snow cone of the South Peak to be the summit itself, were even more thrilled than we ourselves. They thought Evans and Bourdillon had climbed the mountain. I remember Ang Nyima, one of the trio forming Gregory's support party for the second attempt saying to me in slang Hindi "*Everest khatm ho gya, Sahib,*" which in equally slang English might be translated "Everest has had it."

But we knew that we must await their return for definite news, for from that South Peak there remained a long stretch of ridge which had never before been seen close at hand; we had many times wondered what Everest held in reserve on this final part of its defences. It was an anxious wait, with the lurking question ever in mind: Could they come back safely? We could see nothing through the mists swirling around the mountain, tortured by the rising wind.

Then about 3.30 there was a fleeting break at the lower end of it and there, framed in this gap were two little dots at the head of the gully, some 1300 feet above us. I heaved an immense sigh of relief. At least they were safe. They moved slowly and were obviously very tired, but at last they were back among us, telling us of their wonderful first ascent of the South Peak of Everest—28,720 feet. That they did not continue along the final ridge to the highest point was exactly in accordance with my briefing, for I had been most anxious that they should not take risks with their experimental oxygen equipment. It must have been a tantalizing situation to be up there at 1 p.m. that day, so near to the fulfilment of a life's dream and yet knowing that they had neither the time nor the oxygen to reach the summit along the formidable alpine ridge they now saw stretching before them. To continue would not have been in the interests of the expedition, and in returning safely they not only made a fine mountaineering decision, but gave us all enormous confidence in final triumph.

The second assault: Hillary and Tenzing (Hillary's narrative)

"By May 22 we had made the first great carry to the South Col and fourteen 30-lb. loads of vital food, equipment and oxygen were awaiting our use. As we descended to Camp IV after making this lift, we met Bourdillon, Evans and Hunt setting out up the Lhotse Face to make the first assault on the summit. During the next two days we rested and watched their tiny figures on the Lhotse Face climbing steadily to Camp VII and then on to the South Col.

"It was now time for us to move. On May 25 Tenzing and I supported by Lowe and Gregory moved up to Camp VII. The following day we climbed the steep glacier above the camp and then began to cross the great traverse towards the South Col. From here we got our first glimpse of Evans and

Lowe climbing from the South Summit (28,720 feet) towards Camp IX (28,900 feet) in support of the second assault

Hillary and Tenzing preparing for the second assault

The Expedition: left to right, back: T. Stobart, Griffith Pugh, W. Noyce, C. Evans; middle: G. Band, M. Ward, E. Hillary, T. Bourdillon, M. Westmacott; front: A Gregory, G. Lowe, J. Hunt (leader), Tenzing, C. Wylie

Bourdillon on the south-east ridge, obviously moving strongly. Just before we reached the South Col, through a gap in the clouds we saw two tiny specks moving on the South Summit. It was a tremendous moment for us.

"We reached the South Col in time to assist Hunt and Da Namgyal back to their tents after their strenuous efforts in carrying food and equipment to 27,350 feet. Much later in the afternoon, two tired figures descended out of the clouds on the ridge and came slowly down the slope towards the Col. They were Evans and Bourdillon. They told us how they had reached the South Summit, the problems they had been faced with and the difficulties they had had with their oxygen sets. They also reported that the ridge leading to the top appeared to be of considerable difficulty.

"We went to bed that night elated over the success of our companions but not particularly happy about our prospects for the summit. The next day the South Col wind at its worst was blowing and no move upwards was possible. We assisted Bourdillon, Evans, Hunt and Da Namgyal to the top of the Geneva Spur and saw them start off on their long and weary descent to the relative comforts of the lower camps. All night it blew fiercely and although we were ready to leave very early, no start was possible before 8.45 a.m. The high-altitude Sherpas chosen to carry our camp high up the south-east ridge had all fallen ill except Ang Nyma, so there was nothing for it but to carry everything ourselves. Lowe, Gregory and Ang Nyma cut a stairway up the firm, steep snow of the couloir. Tenzing and I followed in these tracks and were able to conserve our strength and make faster time. We caught them up on the south-east ridge near the remnants of the Swiss tent of the previous spring. Despite our large loads we were all going very well. The ridge above, although steep, was generously supplied with foot and hand holds and although we moved slowly up it, we were able to climb steadily and rhythmically, taking every care.

"At 27,350 feet we came to the dump left by Hunt several days previously and reluctantly tied this extra equipment on to our heavy loads. Ang Nyma had just over 40 lb. but the rest of us were carrying between 50 and 63 lb. Moving very slowly now, we hauled ourselves up the ridge, all of us breathing oxygen at the rate of 4 litres a minute. A possible camp site would appear deceptively above us, only to vanish as we reached it. We were all very tired, and indeed a little desperate, when we finally reached a snowy ledge, which although uneven was sufficiently roomy to pitch a tent.

"While Lowe, Gregory and Ang Nyma descended to the South Col, Tenzing and I made a very rough platform, tied our tent down as best we could and crawled in for the night. After a somewhat uncomfortable night, I looked out of the tent very early and was greatly encouraged to see every sign of a fine day. We quickly organized ourselves and at 6.30 a.m. set off up the mountain. The first 500 feet was covered very slowly but steadily. We were going well, and were able to overcome without difficulty any problems we met. But then we reached the great 400-foot face running up to the South Summit, and this was a different proposition. Not only was it very steep but I felt the snow was in a dangerous condition. Laboriously beating a track up it, sometimes to our knees and often deeper, we were always conscious of the tremendous drop to the Kangshung Glacier, 11,000 feet below.

Half-way up the slope I asked Tenzing his opinion and he replied that he was rather unhappy about it and thought it very dangerous. When I asked him whether he thought we should go on, he gave his familiar reply: 'Just as you wish.' I felt we had a fair chance so decided to persevere. It was a tremendous relief however when, 100 feet from the South Summit, the snow became firm and we were able to kick and chip steps up the last steep slopes on to the South Summit itself.

"We sat down and had a drink from our water bottle. We had been using oxygen at the rate of 3 litres a minute and I estimated that this would give us another four and a half hours on our remaining bottle. The ridge ahead looked both difficult and dangerous, heavily corniced on the right, dropping off to enormous rock bluffs on the left. The only possibility was to keep along the steep snow slope running between them. I cut a line of steps down to the saddle between the South Summit and the ridge and was overjoyed to find that the snow, far from being soft and powdery, was firm and hard and that a couple of good blows with the ice-axe would make a step big enough for even our outsize high-altitude boots. We moved slowly and very carefully. I cut 40 feet of steps, then forced my ice-axe into the snow and belayed Tenzing as he moved up to me. Then he in his turn thrust his ice-axe in and protected me as I cut another 40 feet of steps. Moving one at a time and fully conscious that our margin of safety must inevitably be reduced at this great altitude, we forged slowly ahead.

"After an hour's going the South Summit was dropping away beneath us, but I suddenly noticed that Tenzing, who had been going very well, was starting to drag. When he approached me I saw he was panting and in some distress. I examined his oxygen set and, finding that the exhaust outlet from his mask was blocked with ice, was able to give him immediate relief. We moved on again and soon reached the worst problem on the ridge—a great rock bluff which looked far too difficult to tackle directly with our limited strength. There was one possibility: attached to the right-hand side of the rock bluff was a cornice and the ice had peeled away leaving a gap running the full length of the bluff and just large enough to take the human frame. With Tenzing belaying me I moved into the crack and cramponing on the ice behind and using every handhold on the rock in front I wriggled and jammed my way up and pulled myself panting on to the little ledge at the top. I signalled to Tenzing and heaved on the rope until he in his turn struggled up and collapsed exhausted on our little ledge. I really felt now a fierce determination that we would succeed in reaching the summit.

"The ridge stretched on in a never-ending succession of corniced bumps and as I continued cutting the trail round the back of them I wondered just how long we would have to go on. We were starting to tire. I had been cutting steps continuously for almost two hours and wondered rather dully, whether we would have enough strength left to get through. I cut around the back of another hump and saw that the ridge ahead dropped away and that we could see far into Tibet. I looked up and there above us was a rounded snow cone. A few whacks of the ice-axe, a few cautious steps and Tenzing and I were on top. The time was 11.30 a.m.

We stayed fifteen minutes, removing our masks and so conserving oxygen.

After an hour we were back on the South Summit; moving gingerly down the great snow slope, we were able to shrug off the sense of fear that had been with us all day. At 2 p.m. we were at Camp IX, where we brewed some lemonade before setting off on the long trek down to the ridge. We were both very tired, but not too tired to make the last effort of cutting steps down the couloir where yesterday's tracks had already been blotted out. On the Col we were greeted by Lowe and Noyce; the latter had come up that day in support with Passang Phutar, both making their second trip to the Col." (*End of Hillary's narrative.*)

We waited at Advance Base in vain for news all through May 29. Gregory had come down with the two remaining Sherpas of his support team and had raised our hopes by telling us that he had seen Hillary and Tenzing at 9 o'clock that morning, just as he had watched Evans and Bourdillon on the 26th, approaching the South Peak and going well. This, the early hour that he had seen them, and the glorious weather, apparently with little wind even higher up, had given us great confidence that they might have made it. But by evening we were in the dark about the outcome. I had asked Noyce, who with three Sherpas had gone up a second time after Evans, Bourdillon and I had come down, either to reinforce or rescue the second assault party, to lay out sleeping bags on a certain snow slope just below the Col visible to us below—"T" would mean success: two bags laid parallel would mean they had reached the South Peak; only one would mean failure. But as evening approached, mists drifted across the Lhotse Face, and we stared in vain at the blanket of vapour behind which Noyce and Passang Phutar had, in fact, placed the signal.

Next morning part of our anxiety was removed when we counted five specks high on the Face coming down. They were all there and all were moving independently—they were safe and well. Soon after 2 p.m. they appeared again, much closer this time, only a few hundred yards up the glacier above our Camp. Most of us, unable to bear the suspense, went up to greet them and hear their news. As they came towards us the returning summit party made no sign, just plodded on dejectedly, obviously very tired. My heart sank—this must be failure; I tried to focus my thoughts on that third effort which we had kept in reserve. Then, when they were quite close, George Lowe, who was leading the little group, started gesticulating, making unmistakable jabs with his ice-axe towards the top of Everest, frowning down above us.

THE ST. LAWRENCE SEAWAY AND POWER PROJECT

THE HONOURABLE LIONEL CHEVRIER
Canadian Minister of Transport

THE ST. LAWRENCE seaway and power project is of concern to Canada in two vital aspects of national life: transportation and power. The whole basis of Canada's economy is the production of a comparatively few major products for sale in world markets. Many exports must be transported over long distances within Canada as well as beyond, and for them cheap and efficient transportation spells the difference between success and failure. Other production is based on the availability of large blocks of low-cost power, and new

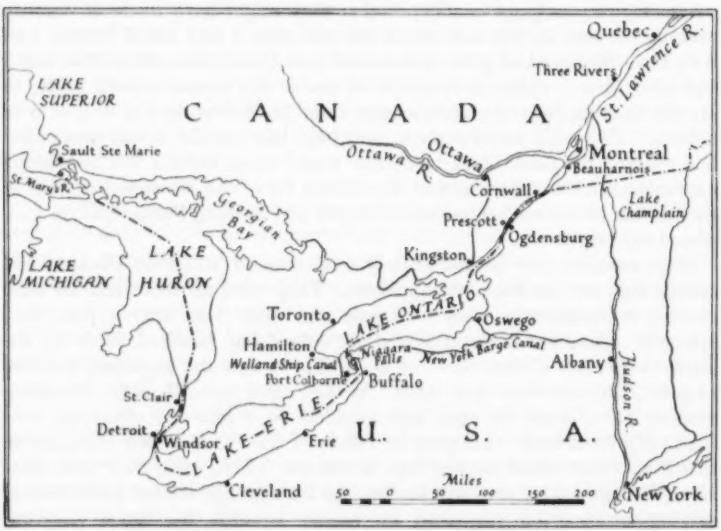
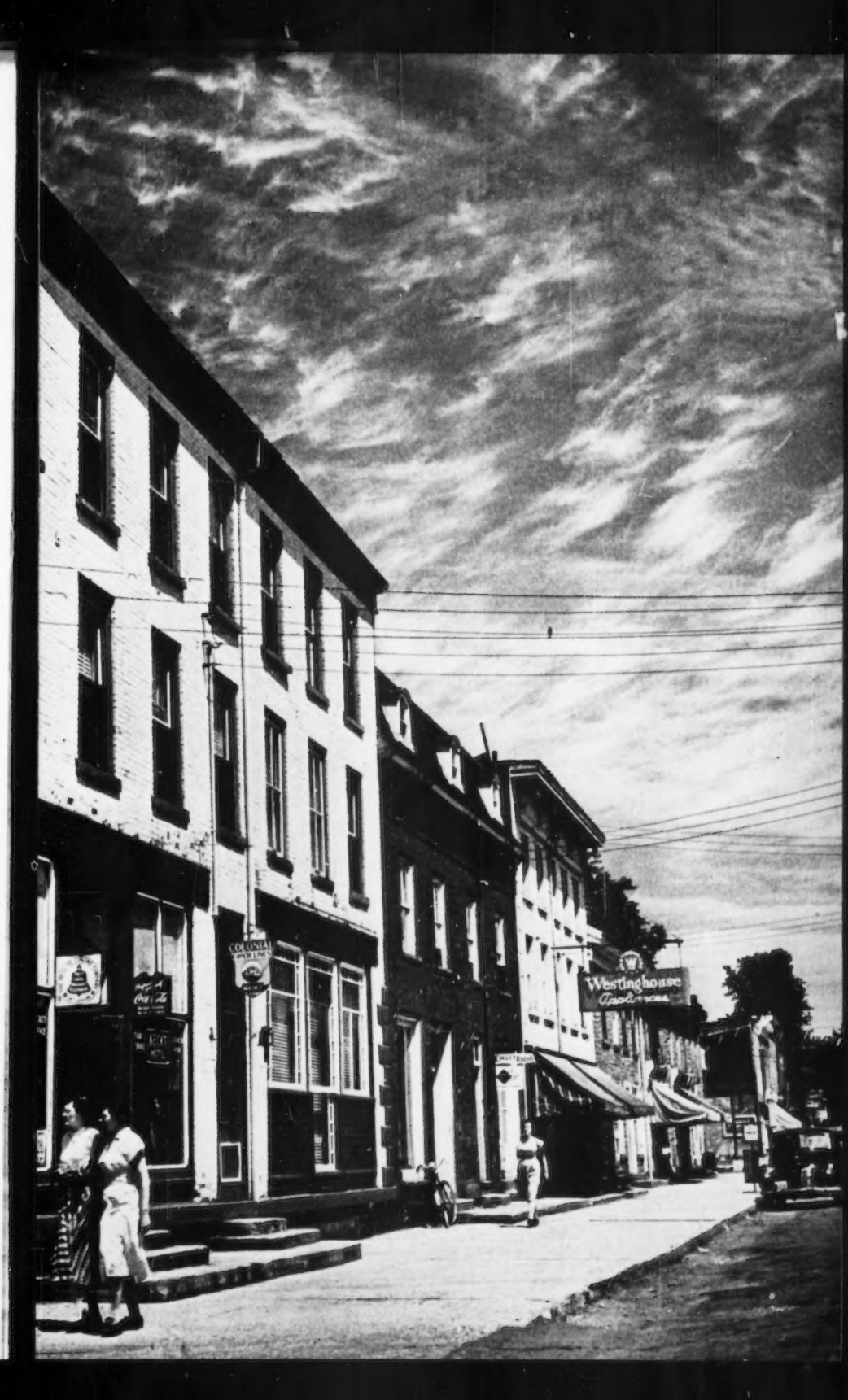


Fig. 1. The St. Lawrence seaway and power project

power sources are needed if the industries are to live and grow. The St. Lawrence project offers cheaper water transportation to the very centre of the continent, and it offers great new sources of hydro power in the industrial heart of Canada.

The fact that the St. Lawrence project remains uncompleted after many years of promotion is due solely to political obstructionism in the United States, not to any engineering or financial difficulty. Tracing the international border from west to east, its course traverses four of the five Great Lakes and their connecting channels, follows the St. Lawrence River to a point just east of Cornwall, and leaves the river there to follow the 45th parallel of

Main street, Iroquois, Ont.: to be flooded when the St. Lawrence seaway is complete
Photo by Malak, Ottawa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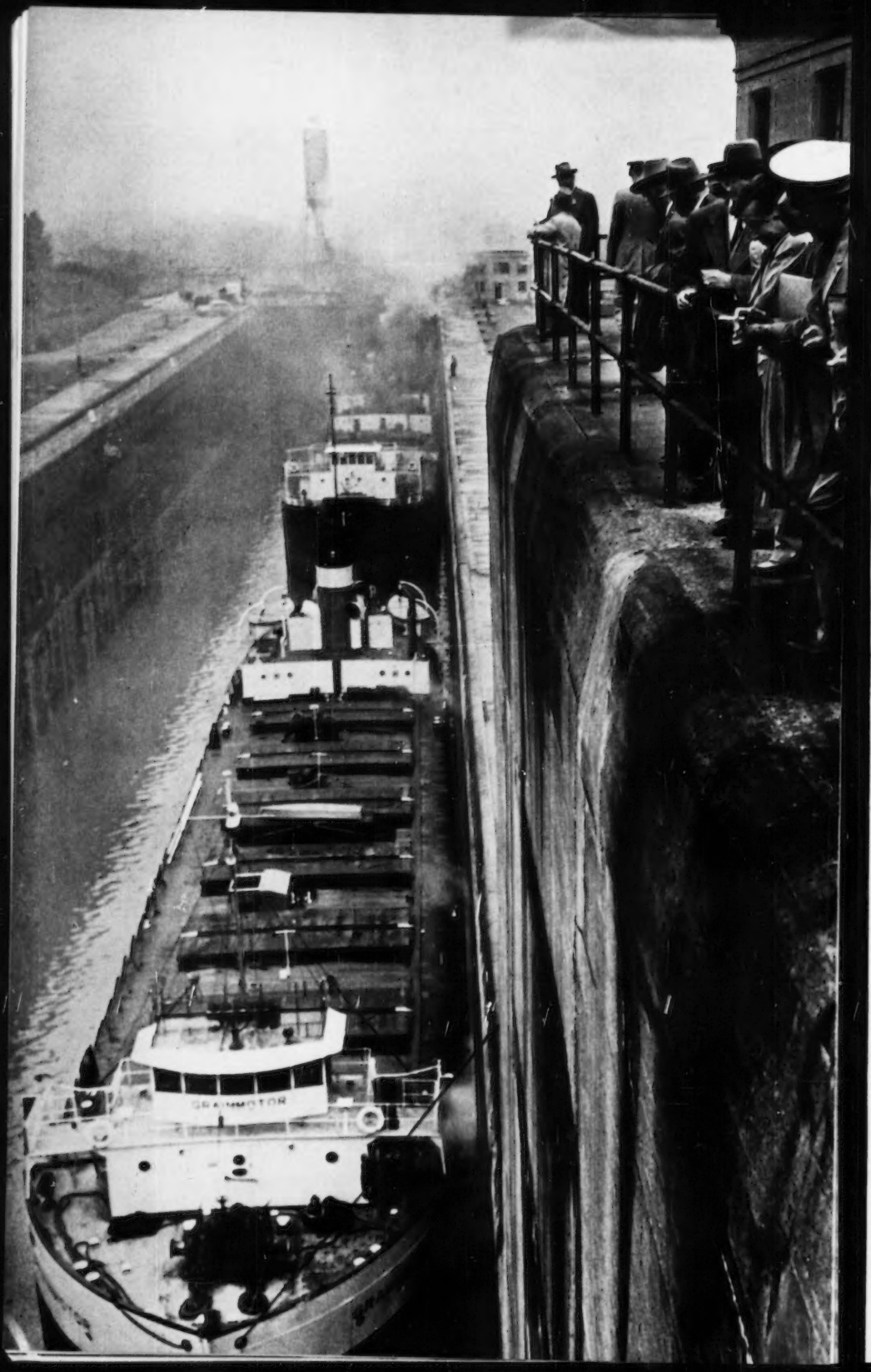


latitude (Fig. 1). Above Lake Ontario, international policies have fostered rather than impeded the improvement of channels for deep-draft navigation, and have permitted several power developments, notably the great installations on the Niagara River between Lakes Erie and Ontario. However, a power development in the International Rapids section of the St. Lawrence River (Fig. 2) is an integral part of current plans for the extension of deep-draft navigation facilities through to Montreal. The power development requires cooperation in some form from the United States. Effective cooperation has not been extended in the past, and has not been forthcoming at this writing, although the prospects are better than for many years.

The St. Lawrence River and the Great Lakes have been an important transportation route ever since the days of exploration, fur trade, and first settlement. These and other inland waterways have played a major role in the country's economic development. For many years water transportation was the only method of movement, and was a determining factor in the location of many important cities.

Water routes had their rapids and other obstacles, however, and efforts to improve them have a long history. Passing over early 11½- and 21½-foot canals,

Fig. 2. The International Rapids Section

the coming of the steamship brought the canal era to this country. By 1832 Canada had 5- and 6-foot canals at Lachine and Soulanges, and an 8-foot Welland canal (Figs. 2 and 1). After the union of the two Canadas in 1840 the St. Lawrence and Welland route was deepened to 9 feet, and following Confederation in 1867 to 14 feet, the latter work being completed about the turn of the century. Meanwhile in 1895 Canada completed an 18-foot canal at Sault Ste. Marie, to compete with earlier United States canals there and protect Canada's interest in the Western grain movement. By 1906 the St. Lawrence Ship Channel had been dredged to 30 feet from Montreal to deep water 40 miles below Quebec.

During most of this period the United States showed little enthusiasm for the St. Lawrence part of the waterway, but rather the reverse, promoting the Hudson Valley route to the interior. The State of New York built the Erie Canal from the Niagara to the Hudson River, completed in 1825 with a 4-foot depth, and deepened thereafter to its present 12 feet. (See "New York Barge Canal," Fig. 1.)

While the United States has yet to make any significant contribution to improvement of the St. Lawrence route below Lake Erie, that country has undertaken the major upper lake developments. These include channel

Thirty foot lock in Welland Ship Canal: projected locks between Prescott and Montreal to be on this pattern

enlargements between Lakes Superior and Huron and between Lakes Huron and Erie, as well as a number of parallel canals at Sault Ste. Marie of which four are still in operation (as is the one Canadian canal there). Behind these works the most potent factor was the growing iron and steel industry, bringing ore from Lake Superior to the coal of Pennsylvania and Ohio. Steel production began to concentrate around Lake Erie and near Chicago, till to-day this area produces about 80 per cent. of all the United States output. In short, low-cost water transportation lies behind the exploitation of the great Mesabi and other iron ranges on the one hand, and the rise of the great steel centres on the other, while the key to the whole is the man-made improvement of a natural waterway. To-day the traffic on the Great Lakes exceeds 200,000,000 tons a season. Indeed the records for 1951 (the latest available) show a total of 206,000,000 tons in five bulk items alone [1]—100,000,000 tons of iron ore, 51,000,000 tons of coal, 26,000,000 tons of limestone, 16,000,000 tons of petroleum and products, and 13,000,000 tons of grain.

Official United States interest in the St. Lawrence route began about the time Canada's 14-foot canals were being completed, stimulated by western pressure for still cheaper access to the sea. Encouraged by this growing sentiment and seeing a new surge in her own western development, Canada in 1913 started construction of the present Welland Ship Canal at Niagara. Work was interrupted by the War, but the canal was opened in 1932. Its locks have 30 feet of water over the sills, a usable length of 765 feet, and a width of 80 feet; these dimensions are to be taken as the standard for the rest of the seaway. The limiting depth in the canal itself is at present 25 feet, but any desired depth up to 30 feet can be achieved by dredging.

The matter of extending deep water navigation to the sea has been under more or less continuous negotiation with the United States since the turn of the century. At an early date the project became one for the development of power as well as navigation. Various international boards have studied the matter over the years, and all reported favourably from both an engineering and an economic standpoint. The proposals were formalized in the St. Lawrence Deep Waterway Treaty in 1932, but that treaty was rejected by the United States Senate. Renewed negotiations produced the Great Lakes–St. Lawrence Basin Agreement of 1941, but after more than eleven years that agreement has not been approved by Congress. As late as June 18 last year the Senate returned an approving resolution to its foreign relations committee for further study. Here we find the United States speaking with two voices, as so often happens with the separation of the executive from the legislative branch of government which our good neighbours enjoy, or profess to enjoy. The Administration has favoured the project these many years past, but Congress has failed to act accordingly, a situation that could not exist in Canada or in the United Kingdom. Now Canada no longer looks for ratification of the 1941 agreement. It has been superseded by a new plan for an all-Canadian seaway, with the associated power development undertaken by separate entities (in Canada, the Hydro-Electric Power Commission of Ontario). An outline of the project will make the plan clear.

The proposed St. Lawrence Seaway is a 1200-mile channel, with a mini-

[1] Annual Report of the Lake Carriers Association, 1951.

mum depth of 27 feet, extending from Montreal to the head of the Great Lakes. Together with the St. Lawrence Ship Channel already mentioned, it will permit large vessels to navigate more than 2000 miles from the Atlantic Ocean to the heart of the North American continent. Coupled with this navigation channel is the large-scale development of power at two sites at least and possibly three. The first is the International Rapids section of the St. Lawrence River, where it is proposed to develop 2,200,000 horse-power, divided equally between Canada and the United States. The second is the Soulanges section, where the Beauharnois development already harnesses about 1,000,000 horse-power, and an ultimate expansion to 2,000,000 horse-power can be accomplished readily. The third site is the Lachine section, where a projected 1,200,000 horse-power might be installed. The latter two sites are entirely within Quebec, it will be noted.

A very large part of the work on this Seaway has been completed already. Deep draft navigation is an accomplished fact throughout the Great Lakes. The largest lock at Sault Ste. Marie was opened by the United States in 1943, with a 31-foot depth. From Duluth and Fort William (on the western shore of Lake Superior) to Prescott, the downbound channels provide approximately 25 feet, and the shallowest upbound channels 21 feet. They serve a great inland fleet that is said to provide the cheapest transportation in the world. The largest vessels load more than 20,000 tons. Again, below Montreal the St. Lawrence Ship Channel to the open Gulf of St. Lawrence is now 35 feet deep. It has made Montreal one of the busiest seaports in the world, attracting all but the largest of ocean vessels.

But between Montreal and Prescott, a distance of 115 miles, the 14-foot canals constitute a bottleneck that keeps the ocean vessels on one side, the lake vessels on the other. The largest vessels that can go through these canals carry less than 3000 tons, most of them about 2500 tons. In this same stretch, less than one-quarter of the available power has been developed. The main concern is the International Rapids section. Installations there would be 2,200,000 horse-power, whereas present installations are under 100,000 horse-power. But whereas the rest of the St. Lawrence power can be developed independently by Quebec, a full-scale power development here must be an international project. Removing the navigation bottleneck and harnessing the water power is the essence of the seaway project to-day. Major works are required in the three sections of the river mentioned above.

The first is the International Rapids section. It is here that the most extensive and costly work is required. The main features are as follows (Fig. 3): an upper control dam near Iroquois; a main dam and power-houses near Cornwall; side canals past each of the two dams; dykes where necessary to retain the pool level; channel enlargement to reduce current velocities in some stretches; relocation of affected railroad lines and highways; rehabilitation of Iroquois, Morrisburg, and other communities. Each of the two dams will be a concrete gravity structure and each will be about 2500 feet long. The control dam will have a maximum height of about 118 feet above the foundation, the main dam about 145 feet. The main dam will extend from the United States mainland to the head of Barnhart Island. The closure will be completed by power-houses extending 3501 feet from the foot of the island

to the Canadian mainland, and by flanking dykes. The new canals are to be 27 feet deep, with locks conforming to the general dimensions of those in the Welland Ship Canal. The canal past the control dam is to have one lock with a small drop of 5 feet or less. At the main dam the drop will be about 85 feet, and two locks are planned in this canal.

The second of the three sections is Soulanges. Here the basic power development already exists at Beauharnois and the power canal incorporates a 27-foot navigation channel. Little more is required than the provision of a short side canal with two twin locks in flight to pass vessels from the power canal to Lake St. Louis.

Thirdly, in the Lachine section, the minimum development will be for navigation alone. This would involve considerable channel enlargement and a 10-mile canal with two locks. But a large-scale power development is possible in this section too. Discussions have been opened with the Govern-

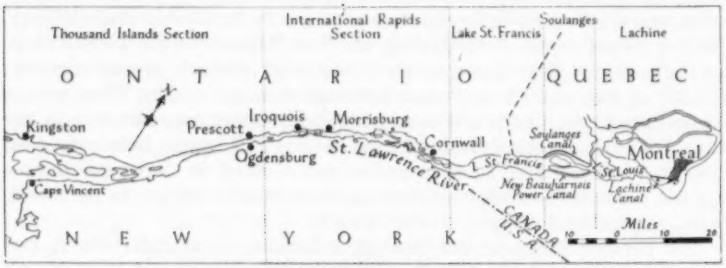


Fig. 3. Sections of the seaway to be developed

ment of Quebec, out of which may come an agreement for a combined power and navigation development.

That covers the three sections of the St. Lawrence River where major works are required. Comparatively minor channel work is required in the two remaining sections, the Thousand Islands and Lake St. Francis, in order to achieve seaway standards for navigation.

Passing on to the Great Lakes and their connecting channels, the Welland Ship Canal is 27 feet deep for about 17 miles of its 28-mile length; it only remains to deepen the remaining parts to 27 feet. Then, above Lake Erie, the achievement of seaway standards would require considerable dredging in the St. Clair-Detroit passage into Lake Huron and in the St. Mary's River between Lake Huron and Lake Superior.

From the Canadian point of view it will be clear that the International Rapids section of the St. Lawrence is the key to the whole 2000-mile waterway. Below Cornwall the river is wholly within Canada and the necessary works will be Canada's responsibility in any event. Above Prescott and into the Great Lakes, Canada can deepen the Welland Canal but need do little else. The Canadian plan, as already indicated, is to have the international power works undertaken jointly by two entities to be designated by the respective governments. With such a development under way the necessary

The present 14 foot Cornwall Canal: scene of future power developments

Photo: National Film Board

canals past the dams would be built on the Canadian rather than the United States side, as had been provided in the 1941 agreement. That would provide an all-Canadian seaway as far as Lake Erie. Canada does propose to deepen the Welland Canal to 27 feet—not a very big job—but does not propose to deepen the river channels above Lake Erie. The United States undertook to do this work in the 1941 agreement, and probably would do it in due course anyway, as soon as the St. Lawrence work starts in fact, as a logical continuation of a programme carried on for over a hundred years.

Parliament provided in December 1951 for the creation of the St. Lawrence Seaway Authority, a Crown Company, to be responsible for the construction and operation of the Canadian seaway. That same month an agreement with the Government of Ontario was approved, concerning the international power development. Then on 30 June 1952, at Canadian instance, the United States joined Canada in requesting the International Joint Commission to approve the construction of the key power works. (The Commission's approval is required in all such cases unless covered by a valid and specific agreement between the two governments.) The Commission issued its order of approval on October 29. On November 4 the United States was advised to the effect that Canada no longer contemplated approval of the 1941 agreement.

Under the new plan a start on the project is only one step away. That step is the authorization by the United States of an entity to develop that country's share of the power. The Power Authority of the State of New York has an application before the Federal Power Commission—a renewal last September 22 of an earlier application—for a licence to proceed, but the Federal Power Commission has not yet announced its decision.[1]

In the United States a new Congress is sitting and a new executive has taken over. New proposals for United States participation in the seaway have been made. Canada has indicated willingness (but not enthusiasm) for a renewed exploration of this possibility, providing that this does not prevent the development of power under present arrangements and does not cause any serious delay in the completion of the whole waterway. The international power development would provide low-cost energy to Southern Ontario, New York and perhaps neighbouring states. That energy is in immediate demand on both sides of the border. The St. Lawrence is the only major source of hydro power remaining to serve Southern Ontario. The market here is growing so rapidly that, in a province which has grown up on cheap hydro power, two large steam plants are being rushed to completion to provide almost 900,000 horse-power, and already are in partial operation. Without the St. Lawrence power, resort must soon be had to still more steam generation at more than twice the delivered cost.

Southern Ontario contains industrial plants comprising approximately half of the nation's total manufacturing capacity. Large-scale users of power include producers of abrasives, picrite, and nickel, all on the critical list of defence materials, with the nickel accounting for 90 per cent. of the free world's supply. The region fabricates 90 per cent. of Canada's aluminium

[1] As this goes to press the Commission's approval has been given, but it is expected that the decision will be challenged in the courts under established legal procedure.

Long Sault Rapids, near Cornwall; to be submerged by projected power developments

Photo by Malak, Ottawa

products, two-thirds of its steel, half its copper and chemicals, 90 per cent. of its magnesium, and all of its cobalt, calcium and platinum. It manufactures 80 per cent. of the transport, 60 per cent. of the electronic equipment and 55 per cent. of the aircraft used by the Canadian armed forces. Other products include cobalt, selenium and tellurium. Studies by Ontario Hydro indicate that without St. Lawrence power there will be increasingly severe shortages of low-cost energy in this area by 1957; it will be abundantly apparent that Ontario cannot afford to be without that energy. Again, a power development at Lachine would serve great industrial markets in the Province of Quebec, where demand also is growing rapidly. This province is fortunate in that other hydro sites remain to be developed besides Lachine. Nevertheless, Lachine power will be required in due course anyway, and a development in connection with the seaway appears to offer considerable advantages.

With respect to navigation, it is the significance of the seaway for the iron ore development in Labrador that is receiving most attention to-day. In spite of a welter of confusing testimony, the essential facts will be quite clear to anyone who takes the trouble to winnow the wheat from the chaff. The most obvious benefit, from a Canadian point of view, is that the Seaway will open a much larger market for ore from Labrador than could otherwise be reached. The mining development is going ahead now, with first shipments expected in 1954. The initial goal is to ship 10,000,000 tons a year, and that is said to be the minimum that would justify the development. Some ore may be sold overseas, some to mills along the Atlantic coast, but the bulk of it must be sold to inland mills, moving either via Montreal or, say, Baltimore or other east coast ports. With existing transportation facilities and at present ore prices it cannot hope to compete much farther inland than Pittsburgh, except for a comparatively small volume that could be moved by 14-foot canallers to Lake Erie ports. In that Pittsburgh market it will meet strong competition from Venezuelan, Chilean, Liberian and other imported ores. In these circumstances it is not likely that the minimum sales objective of 10,000,000 tons a year would be much exceeded. Completion of the seaway would open the whole Great Lakes market to the ore from Labrador. With its opening the mining interests see an immediate sale for at least 20,000,000 tons a year, just double the present goal, and a growing market thereafter.

But there is another side to this medal too. That is the problem of ore supplies now facing the steel mills within reach of the Great Lakes, which account for about 80 per cent. of steel production in the United States. For many years the backbone of this production has been the high-grade iron ores of the Mesabi, supported by other ranges near Lake Superior. Production of these ores can no longer keep up with mounting demand, and the mills are seeking additional sources of supply. It has been said that the Lake Superior ranges are nearing exhaustion. That is simply not so. But the point is that production of the ores now in use has just about reached, if it has not passed, its maximum annual rate. The rate could be kept high for some time by resort to higher-cost operations, but that would no more than postpone a decline that may be gradual but appears inevitable. The great Hull-Rusk-Mahoning mine of the Mesabi range, "the big pit," is now all but worked out. Opening new pits now involves removing deep overburden from the ore bodies, costly

in time as well as money, and much of the ore that remains must be mined by under-ground methods, which means working to a set programme. Meanwhile ore requirements continue to rise, not only because of additions to steel capacity, but because with a shortage of scrap it is taking more pig iron to make a ton of steel. (Scrap is mixed with pig to make steel, normally about 50–50, but the proportion may vary widely according to the comparative price and availability.)

Seaway or no seaway, the steel mills are going to get the necessary ore, make no mistake about that. But at a price. That is the point—at a price. The additional supplies may come partly from more costly workings of high-grade ore, as just explained, partly from more costly development of taconite and other low-grade iron sources, and partly from imports brought farther inland with greater transportation charges. To put the same thing another way, the necessary supply will be forthcoming from those various sources only if the steel mills offer a higher delivered price for ore. At the moment no one can say precisely how much higher, but the indications are that the increase may be a couple of dollars a ton or more within a comparatively few years. Ore shipments from the Lake Superior ranges in 1951 exceeded 100,000,000 tons, including Canada's Michipicoten and Steep Rock mines. The ore requirements of the consuming mills will be at least 120,000,000 tons and probably more in the very near future. Thus there is in prospect an increase of something like $250,000,000 a year in the cost of raw material for the steel mills, and an even greater increase in the price of the final steel products.

This prospect would be completely changed by the seaway. If it existed to-day, it would enable Labrador ore to compete at present ore prices in virtually all of the Great Lakes districts. The ore occurs as outcroppings or with very light overburden over vast areas, so any number of pits could be opened readily and production could be expanded at low cost to meet any likely level of annual demand. In these circumstances, that figure of $250,000,000 a year is just one of the costs of *not* completing the seaway. It is a cost that would have to be met by the ultimate consumers of iron and steel. In just about one year it would outweigh the total cost of the new navigation works in the St. Lawrence.

At least two other benefits relate to the movement of grain, coal and other commodities. One is an annual saving of more than $30,000,000 in the cost of transportation, after paying any likely level of tolls. The other is an end to the shortages of lake shipping that have occurred from time to time in the past to hinder the flow to market, particularly of grain.

The saving in shipping charges would be great enough if it were no more than a matter of allowing large and efficient carriers to move from the head of the lakes right through to Montreal or the sea. As it is now, grain cargoes are transferred from large lakers to small canallers or back to rail at various points from Port Colborne to Prescott. The Board of Grain Commissioners allows a freight charge of 8 cents a bushel for the water movement of wheat from Port Arthur and Fort William to Toronto, about 900 miles. For the remaining 300-odd miles to Montreal, where the movement is entirely in canallers, the allowance is another 8 cents a bushel. If the large vessels could

carry the wheat the whole 1200 miles to Montreal, it is reasonable to speculate that the total water freight to-day would be not more than 11 cents a bushel, instead of 16 cents. That would be a saving of 5 cents a bushel in freight rates alone, not counting the saving in trans-shipment charges, which are not less than another cent a bushel.

But the savings promise to be even greater than that, thanks largely to the upbound movement of iron ore now in sight. Carriers delivering ore from Seven Islands to Lake Erie ports would find it of advantage to carry grain on their return. They would have to clean ship to do so. But they could pick up grain delivered to Port Colborne, say, or they could proceed on to the head of the lakes to pick up grain for Montreal or beyond. The result would be a better balance of up and down cargoes, hence a more efficient use of shipping. And since the upbound cargoes promise to outweigh the down—just the opposite of to-day—competition for those down cargoes should tend to lower the rates to give them the greater part of the benefit from this additional economy.

In the past it has been customary to talk of ocean vessels coming in by the seaway to load grain directly at the lakehead. The new pattern just outlined suggests that this will be the exception rather than the rule. At the competitive rates likely to become established, it would appear that an ocean vessel could not afford to enter the lakes for a cargo, unless it also carried a pay load on its inbound voyage. Quite a few may be expected to have this advantage, and ocean entrants may thus be numerous. Putting the matter in perspective, however, most ocean vessels will find it more profitable to pick up their cargoes at Montreal or some other transfer point, and those that do enter the seaway will be far outnumbered by inland ore carriers, for example. The physical possibility of bringing in ocean vessels is nevertheless important. It will permit the inland fleet to be supplemented from outside, should a shortage develop in shipping space. Accordingly, such shortages should be much less serious in the future. As it is now the only vessels that can enter are the small canallers. It takes pretty high rates to attract them very far into the lakes, and even so they are not very effective. Their capacity is small, their numbers are limited, and they have their own normal business to handle.

It is to be noted further that the combination of power and navigation development will stimulate industrial expansion in Ontario and Quebec. One must not look for miracles, however, and hence it is not suggested that the present very rapid growth is to be further accelerated. It is suggested rather that there will be encouragement for the continuance of that growth. Low-cost transportation and ample power reserves are two important factors in determining the location and expansion of industrial plant. They are not the only factors, of course, and their importance varies with the nature of the production process and the materials handled. They mean a great deal to an ore smelter or a paper mill, for example, but very little to a maker of shoes or shaving brushes. Nevertheless, in total impact they promise a great deal for this area.

The project is most important among the various defence-supporting activities on which direct armed might depends. Perhaps its greatest con-

tribution would be in the matter of iron ore supplies, already referred to. The demand for ore has risen sharply in the present period of preparedness, and would rise sharply again on the outbreak of a major war. The Lake Superior production has lost the ready expansibility that met just such sudden demands in two world wars past, hence new supplies could come only from imports or from the use of taconite or other low-grade material. Taconite is a loose name applied to several complex iron formations. Truly vast quantities exist in the Lake Superior ranges, where the iron content averages about 25 per cent. It would require concentration before smelting, but no such process is yet in commercial operation. A process for treating magnetic taconite, one of the several types, is said to have passed the pilot plant stage and small-scale production may be expected soon. But the capital cost is high. This means for one thing that the product can hardly hope to pay its way at less than capacity production, and hence that plants are unlikely to be built ahead of assured demand on lengthy contracts. In other words, such plants promise little in the way of reserve capacity, either in themselves or in combined management with high-grade ore mines. Once a war started, on the other hand, the country could ill afford either the time or the materials to build additional plants.

As for imports, seaborne ores would be highly vulnerable to submarine attack, the major menace. Thus the great steel mill at Sparrow's Point, Maryland, normally operates on imported ore, but carrier losses during the late war caused it to cease importing and draw entirely on domestic ore moved by rail from as far away as the Lake Superior ranges. With the seaway open however all the necessary ore could be moved from Labrador in comparatively safe inland waters.

Again, the seaway will permit any but the largest of naval and ocean vessels to be built in inland yards, adding flexibility and dispersal to a wartime shipbuilding programme. The value of this contribution has been questioned, on the grounds that the role of inland yards can be confined to small vessels. But in the late war it was found necessary to build twenty-eight large submarines and seventy-two cargo vessels of 5000 ton capacity on the Great Lakes, though they had to be squeezed out with great difficulty through the Chicago Drainage Canal and the Mississippi River. Surely it is obvious that more and bigger vessels would have been built on the lakes if the seaway had been open.

There are at least three other contributions to defence. The project will create a reserve of power in a great industrial area to be drawn on in the emergency. It will provide a new transportation route between the factory and battlefront, supplementing the railways which were so hard pressed in the recent effort. And the stimulation to industrial growth mentioned already will make Canada that much better able to produce in volume the specialized needs of modern war. It is objected that seaway facilities could be damaged or destroyed by a determined air attack. The same could be said for any one of the existing hydro developments, steam power plants, the locks at Sault Ste. Marie, the ore docks on Lake Erie, taconite concentration plants, the steel plants themselves, or the railway lines. But an enemy would find it extremely difficult to knock out all the various alternatives at the same time. The military leaders responsible for defence planning in Canada and the

United States are on record to the effect that the risk is a reasonable one and that the project warrants a high defence priority.

Again it is objected that Canada cannot afford to divert men and materials to seaway construction at this time. But on the contrary, no time is more appropriate than the present. In these days of cold war, which may continue for a generation for all we know, it is necessary not only to prepare against the threat of immediate war, but also to strengthen our economy for the long pull. That is just what the seaway will do. For without the seaway, other hydro or steam power capacity would be required, more ore concentration facilities, other transportation facilities for ore and other commodities, and a large and costly commitment of ships and men to guard ore carriers at sea.

A very brief word on costs, almost as an anti-climax. If the project proceeds as an all-Canadian seaway, the cost of all the works necessary for an international power development will be borne by the power agencies, something over $400,000,000 at 1950 prices. The cost of adding the navigation facilities from Montreal to Lake Erie would be somewhat more than $250,000,000. These sums represent very considerable expenditures, to be sure. However, the facilities would not be provided as a gift to anyone; they would be self-liquidating. Hydro users would pay the capital, interest, operating and maintenance costs relating to power, and tolls levied on shipping would recover the similar navigation costs. In other words the expense would be borne by the beneficiaries.

Again, large as the expenditure would be, it would be well within Canada's resources. On the hydro side, Canada has built its Shipshaw, its Beauharnois and other projects, and is expanding its Niagara and building its Kitimat. On the navigation side, Canada has already spent over $300,000,000 in providing the Ship Channel below Montreal, the 14-foot canals into Lake Ontario, the Welland Ship Canal and a lock at Sault Ste. Marie. Most of those expenditures date back to years when a dollar meant a great deal more than it does to-day, and when Canada was much poorer in material resources. The work and material that went into the Welland Canal alone would cost a great deal more than $250,000,000 to-day.

Water transportation has played a large part in the growth of Canada from its scattered colonial beginnings right up to the present. It provides a basic support for much of the Canadian economy to-day, and is particularly important in the bulk movement of grain, ore, coal and forest products. Low-cost hydro power is the basis of successful Canadian production in many other industries serving domestic and world markets. With its wide significance in both these fields the St. Lawrence seaway and power project is the greatest vehicle of resource development presently before us. It is urgent for defence, and essential for peace if we are to realize the full promise of the future. We are determined to see it through and that promptly.

THE RECLAMATION OF THE FOREST BELT OF THE U.S.S.R. IN EUROPE

ACADEMICIAN A. A. GRIGORYEV

THE METHODS of transforming nature in the various natural regions differ radically from each other depending upon differences in natural conditions. In the forest-steppe, steppe and desert belts, about the transformation of which I wrote in 1952,[1] attention is focused, as I showed, on combating drought and providing the land with sufficient moisture.

In the forest belt of the European part of the U.S.S.R. attention has to be centred around the elimination of a set of entirely different unfavourable conditions connected, first of all, with the former glaciation of the territory, which left many boulders on the land, and with the specific features of the water balance of the soils in the forest belt; namely, with the long periods of excessive moistening of the soil that occur during the year. In spring this excessive moistening is due to the melting of snow, in summer and autumn to irregular rainfall which at times is very abundant.

The fight against surplus moisture in the soils of this forest belt is made difficult by the fact that periods of surplus moisture sometimes give way to periods of drought, which is connected here with the extreme irregularity of precipitation both throughout the year and in different years. Annual precipitation moreover in the forest belt of the European part of the U.S.S.R. is not very great: it is not above 550–650 millimetres in the western part, and 500–600 millimetres in the eastern. The excessive moistening of the soil results from the disproportion between the amount of annual precipitation and the amount of sun heat penetrating the soil surface which is spent, primarily, on the evaporation of soil moisture.

At the southern boundary of the forest belt of the European part of the U.S.S.R. the amount of sun heat which the earth's surface receives is only a little less than the amount necessary for the evaporation of the annual precipitation. However, to the north this disproportion increases, so that at the northern boundary of the forest belt the annual amount of sun heat absorbed by the surface of the earth (the radiation balance of the earth's surface) is already only about one-third of the amount necessary for the evaporation of the annual precipitation. True, the surplus moisture is removed through the surface and subsoil outflow of water to the rivers and then to the ocean, but the greater the above-mentioned disproportion the more time it takes to free the land of the surplus moisture and the greater the danger of long and excessive moistening of the soil, particularly under the conditions of the flat relief prevailing in the European part of the U.S.S.R. This danger at all times of the year is greatest in the northern part of the forest belt. Further south this surplus moisture usually occurs in spring when much heat is spent

[1] A. A. Grigoryev, "Soviet plans for irrigation and power: a geographical assessment," *Geogr. J.* 118 (1952) 168.

on the melting of the snow, and in autumn when the amount of sun heat rapidly decreases.

The periodic superabundance of water in the soil characteristic of the forest belt in the European part of the U.S.S.R., harmful as it is to farm crops, may with good drainage become a favourable condition for the development of forest vegetation which occupies large areas here, and also for the growth of grasses. This accounts for the abundance of meadows. But in places where the natural drainage is insufficient, surplus moisture causes bogging and has a deleterious effect not only on farm crops but also on the development of forest and meadows. Lands with very poor drainage are covered here with peat bogs which occupy an area of more than 20 million hectares. The peat bogs spread throughout the entire belt, but they are particularly numerous in the north.

Long, even periodic, supercharging of the fields with moisture, besides bogging them, leads to crop failure due to water-logging, hinders the aeration of the soil and sharply decreases the effectiveness of the fertilizers placed in the soil and of other agrotechnical and ameliorative measures. The water balance, characterized by long periods of surplus moisture, has an unfavourable effect on the heat balance of the soil because the greater part of the heat which reaches the surface is spent on the evaporation of the moisture instead of warming the earth. This creates unfavourable thermal conditions for the development of the roots of plants. Thus the application of measures for combating surplus moisture is the most important link in the work of reclamation in the forest belt. The nature of the water-heat balance in this belt is responsible for another specific feature of the local soils; namely, their comparatively low natural fertility (when utilized for agricultural purposes), even in cases when water-logging does not occur. As is known, this is due to a number of reasons.

Surplus moisture in the soil has an unfavourable influence on the development of bacteria which decompose the plant and animal residue and convert it into humus. The mycelium of fungi, which develops luxuriantly in the water-logged soil, does the same work but produces considerably less humus; besides, the quality of the humus is not the same—it possesses a sharply expressed acid reaction and is much more soluble in water. That is why it is washed out comparatively easily from the upper humus horizon to the deeper layers. Here the humic acids extensively leach out the lower layer of the soil and transform it into a podzol horizon not only void of organic substances but also lacking mineral nutritive substances. True, part of these substances is carried out from the upper two horizons and is deposited in the third horizon underlying the podzol; however, it is deposited here for the most part in the form of chemical compounds which are poorly assimilated by plants. Besides, in this horizon aluminium and iron compounds are formed which are harmful to certain cultivated plants. Another unfavourable feature of the podzol soils is the absence of a loose crumb structure which is best for the development of farm crops.

It is interesting to note that the greatest mass of the roots of natural, even forest, vegetation lies in the most friable thin upper humus horizon. True, roots of some of the plants penetrate deeper, but they do not branch in the

podzol horizon, and only begin to do so in the next (third) horizon. Nevertheless, the number of roots in the latter is much smaller than in the humus layer. That most of the roots are found in the humus horizon is explained not only by the fact that it possesses more nutriment and is much looser in structure but also by its more favourable water-heat balance for the development of the roots. This horizon dries more rapidly and is better warmed. The thickness of this principal nutritive horizon of the podzol soils, and of its humus content, directly depends (in the presence of drainage) upon the correlation between the heat and moisture that penetrate the soil. The greater the disproportion between the amount of heat and moisture the thinner and poorer in humus it is. As we saw above, this disproportion is very great in the north and gradually decreases to the south. As a result, the podzol soils typical of the northern (*taiga*) part of the forest belt have a humus horizon only a few centimetres thick; to the south (in the subzones of the southern taiga and the mixed forests) sod-podzol soils are formed with a layer of humus (sod) growing thicker to the south; the amount of organic nutrition in it continues to increase. Here the bacteria play an ever greater part in the formation of humus and promote the development of the more stable dark-coloured humus substances; as a result the intensity of the podzol-forming process is noticeably decreased in the south and the soils often become weak-podzol sods.

Thus, in the greater part of the forest belt of the European part of the U.S.S.R. the processes of the leaching of nutritive substances out of the soil (the formation of podzols) proceed more or less intensively depending upon the periodic over-moistening of the soil. That is why one of the most important tasks of transforming nature in the forest belt is not only the elimination of surplus moisture in the soil but also the complete reconstruction of the soil cover of the arable areas—the creation of a soil rich in nutritive substances and possessing a loose crumb structure which ensures the best assimilation of these substances by cultivated plants.

Naturally, soils of the marshland type that have come under cultivation must also undergo complete reconstruction for which special methods have been elaborated. As already noted, the reconstruction of the soil cover includes the removal of boulders, which greatly interfere with the cultivation of the soil by machines, and the conducting of various ameliorative measures by means of mechanical implements. Particularly great is the amount of boulders in the west of the European part of the U.S.S.R. within the boundaries of the distribution of the last ("*Valdai*") glaciation. The ice of this glacial period came from Scandinavia, spreading from north to south—approximately from the Mezen Bay to 60° northern latitude, then turning south-west to the upper reaches of west Dvina and from there to the west—south-west. There are many boulders outside this territory in the zone of the former Moscow stage of the Dnieper glaciation. The boundary of this glaciation crossed the European part of the U.S.S.R., in general from north-east to south-west, passing somewhat east of Moscow and in the south, near the estuary of the Sozh River (the Dnieper basin), turned to the west.

There are fewer boulders in the belt between the boundary of the Moscow

stage of the Dnieper glaciation and the generally known boundary of the maximum glaciation beyond which no boulders are found. Clearing the arable areas of boulders is one of the major tasks of transforming nature in the districts of the former glaciation, especially in the west of the European part of the Soviet Union, where they are particularly numerous.

The chief economic problem of transforming nature in the forest belt of the European part of the U.S.S.R. is the proportional development and the close interconnection of agriculture, cattle breeding and forestry. The combined development of agriculture and forestry in these parts is necessary for the following reasons. As long ago as 1934, J. V. Stalin had pointed to the fact that this belt possesses 5 million hectares of virgin soil covered with brushwood and that "if this land were cleared of scrub and a number of organizational measures were undertaken, it would be possible to obtain a vast area for planting grain, which at the usually high yield in these districts could supply no less grain for the market than is now supplied by the Lower and Middle Volga."

Thus the expansion of the agricultural lands is quite possible without reducing the areas of the chief stretches of forest. The retention of the latter and the proper forest management providing for the reforestation of the cleared areas are extremely important in many respects. The most significant are the following: possessing a considerably greater transpiring surface than herbaceous vegetation, the forests exert a beneficial influence on the decreasing of surplus moisture in the soil; by reducing the surface outflow of water the forests protect the neighbouring fields against soil erosion; by retarding the melting of snow and the outflow of subsoil waters the forests also exert a great water-preserving and water-regulating influence; they lower the level of the rivers at the time of the spring floods and raise their level during the low-water period. This is of great significance for river navigation and for the work of the rural hydro-electric stations.

Furthermore, the large forests regularly supply wood for the woodworking industry, building material and local fuel, and in this way play an important role in satisfying the requirements of the national economy of the U.S.S.R. and the needs of the population of the forest belt.

The abundance of forests in the European part of the U.S.S.R. and the excellent climatic conditions for the growth of grasses create an extremely favourable situation for combining livestock breeding and plant growing, which will ensure the highest agricultural productivity of the land. All these considerations serve as a basis for the transformation of nature in the forest belt of the European part of the U.S.S.R. The means of transforming nature vary, depending on whether the land is used for agricultural purposes or forestry.

Let us first turn to the methods of transforming nature, elaborated by Soviet scientific and practical research institutions for the lands that will be used for agricultural purposes. As has already been noted, these measures are based, first of all, on the elimination of the periodic or permanent surplus of water in the soil and the reconstruction of the natural soil cover. It has been calculated that, in the west of the forest belt of the European part of the U.S.S.R., 17 per cent. of the ploughlands and 33 per cent. of the meadows

and pastures require draining, while in the eastern part 6 per cent. of the ploughlands and 25 per cent. of the pastures must be drained.

The old method of draining soils by building a dense network of open ditches cannot be applied under the conditions of Soviet large-scale mechanized farming since it makes difficult the application of advanced agricultural and land-improving machinery. Another serious defect of the old method of draining was its incompatibility with the preservation of a sufficient amount of moisture in the soil in case of drought. Taking into consideration the necessity of combining the elimination of the periodic water-logging of the soil and the preservation of moisture in it in case of drought, Soviet institutions have elaborated a special method of combating periodic surplus moisture which consists chiefly in distributing the soil moisture throughout a thicker loose soil layer of 30 centimetres and over. Experiments have shown that an arable layer 30 centimetres thick can absorb without being logged with moisture up to 50 millimetres of summer rain and in spring a considerable amount of melted snow. On the podzol, sod-podzol and peat soils which do not require regulation of the water balance the loosened soil layer must be not less than 27 centimetres thick. If measures to regulate the water balance are required the depth of the arable layer must be 30–35 centimetres.

In a number of cases the creation of a thick loose layer alone is quite sufficient to eliminate surplus moisture in the soil. If there is still danger of surplus moisture being left, then by means of mole-ploughs making mole-tunnels which remove the surplus moisture and increase the aeration of the soil, the cavities thus made are arranged across the slope. In case of drought and the drying of the entire arable layer the water accumulated in the sub-arable horizon will rise along the capillaries to the arable horizon and be absorbed by the roots of the plants.

To combat permanent water-logging of the soil or its extremely great periodic moistening the indicated measures alone are insufficient. It is therefore necessary at the same time to find means of removing a greater or lesser amount of subsoil and soil water. For this purpose Soviet institutions have elaborated different methods which combine the laying out of a sparse network of permanent open ditches with other methods of removing surplus water. One of these methods is ploughing along the slope combined with the laying out of transversal drain furrows that send the water into the sparse network of permanent ditches. Another means consists in mole draining and discharging the water into temporary transversal ditches which direct it into a sparse network of permanent ditches. The network of permanent open ditches is so arranged in these cases that they lie 10–20 hectares apart, which makes it possible to apply machinery. In a number of cases this system of drainage has to be applied as a temporary measure even on areas where, later on, the creation of a thick loose arable and sub-arable layers will be quite sufficient. The creation of a thick loose layer is often impossible without a preliminary draining of the land.

For areas that require a constant ejection of water an even better method of removing surplus moisture is the creation of subdrainage which consists of a system of drain pipes laid out in the subsoil 30–50 metres apart, running parallel to the main canals. These pipes send the water flowing into them to

the transversal closed collecting channels, spaced 150–200 metres apart. Along them the water passes to the open main canals. These are spaced 400–600 metres apart, so that the sections between the open canals will have an area of 60 hectares and more, a significant advantage of this method of drainage for the cultivation of fields by machines. In cases where the areas drained by this method lie on a level differing little from the level of the rivers into which the surplus water is ejected, extra work is required to regulate the rivers so as to lower their level and ensure the required speed of their flow.

An indispensable prerequisite for the creation of a thick loose soil layer and the drainage systems is removal of the boulders. This is accomplished by special machines put out by Soviet industry. Approximate calculations have shown that in the forest belt of the European part of the U.S.S.R., not counting the territory which it is not profitable to clear because of the extremely large number of stones on it, 11,050,000 hectares will have to be cleared of boulders. Of this area about two-thirds are ploughland, the rest hayland. About three-quarters of this area lie in the western half of the forest belt under consideration.

It has been calculated that 1041 million tons of stone will have to be grubbed up and removed from this area. Part of the stone will go for building houses and roads, while the boulders with a diameter of 30 centimetres and more can be profitably used for building "stone drainage," that is, filling up the lower part of the ditches with stones and in this way creating subdrainage instead of draining by means of the laying out of drain pipes. The rest of the grubbed-up stone will be unloaded on plots unfit for cultivation and used later on whenever needed.

Thus, besides the removal of the boulders there are two tasks facing the reconstruction of the arable soils in the forest belt of the European part of the U.S.S.R., namely, the creation of a loose crumb structure and the alteration of the chemical composition of the arable layer. To create and maintain the loose crumb structure of the soil, lea crop rotations are introduced in combination with a special system of ploughing and cultivating the soils more complicated than in the black earth zone. This is called for by the fact that the loose crumb structure of the soil in the forest belt obtained as a result of agronomic measures is less stable than in the black earth soils.

The reconstruction of the soils in the forest belt, which are for the most part poor in nutritive substances, requires their constant enriching with mineral and organic fertilizers. The podzol and sod-podzol soils which possess an acid reaction require liming to neutralize them. As a rule, it is necessary to apply also nitrogenous, phosphatic and potassium fertilizers, the amount and form of which depend upon the specific features of the different soils. In some districts magnesium, copper, cobalt and also boric (especially for leguminous herbs) fertilizers are required. Of tremendous significance is the application of the biologically most active organic fertilizers. Among them are:

(*a*) Green manures—the ploughing in of the green mass of leguminous plants (lupine, sweet clover, serradella) or, if areas formerly overgrown with brushwood are developed, the ploughing in of the shrubs;

(*b*) Dung-phosphatic composts (dung enriched with superphosphates), peat-dung and peat-faecal composts enriched with phosphoric flour, ash, lime, etc.

In view of the correlation between plant growing and cattle breeding prevailing at present in the forest belt, which is characterized by an insufficiency of dung, and in view of the abundance of peat beds, especially great significance attaches to the application of peat composts. They are obtained in different ways, primarily by using peat from the upper, comparatively little-decomposed, horizons of sphagnum (upland) peat bogs as litter for cattle and by laying out in the cattle sheds and stables peat floors 30–40 centimetres thick from the normally decomposed peats of the sphagnum peat bogs. Such floors serve not less than two years. The great water capacity and low heat conduction of peat greatly raise the worth of peat litter and peat floors in the cattle sheds, poultry yards, etc. Whereas in preparing valuable composts from the peat of the upland peat bogs, which is poor in mineral substances, the peat must be supplied, besides the dung and faecals, with phosphorus, calcium, potassium and such micro-elements as copper, manganese, magnesium, boron and others, the composts of peat from the lowland bogs are usually rich in mineral nutritive substances and often do not require such additions.

According to the data of research institutions the advantage of applying peat composts for manuring instead of dung lies in the fact that the peat-dung and peat-faecal composts decompose much more slowly and thus better supply the soil with humus and impede the washing out of the mineral fertilizers they contain; the peat composts also have a better effect on the formation and the preservation of the crumb structure of the soils.

Manuring of the fields with well-decomposed peat saturated with liquid dung was applied by the peasants of the Archangelsk Gubernia about two hundred years ago. As for the use for agricultural purposes of drained marshlands (lowland ones, as a rule, which are richer in mineral substances) these lands are especially good for forage and vegetable crop rotations, for the cultivation of perennial grasses, vegetables and silo crops.

One of the major tasks of transforming nature in the forest belt of the European part of the U.S.S.R. is the radical improvement of the meadows and commons. The area of these lands in the southern part of the forest belt is about 50 per cent. that of the ploughlands, in the central part about 80 per cent., while in the northern part the area of forage lands is two to four times greater than that of the ploughlands.

First-rate forage qualities are possessed by most of the floodland meadows of the bigger rivers where during the spring floods the flood water annually deposits fertile silt, the chief source of which is the washing away of the soil with the manures it contains from the fields. As for the "lowland" meadows located in other depressions of the relief that often suffer from bogging, and also meadows in the dry areas, the forage properties of their grass stand and their fertility in no way meets the present-day requirements of agriculture. The huge areas of these meadows require radical reconstruction. There are often valuable forage grasses on these meadows but they are depressed since

they do not find the necessary conditions for their development. In such cases excellent results are obtained by applying, especially in spring, nitrogenous, phosphatic and potassium fertilizers without ploughing the land (if the sod is intact). On the big stretches of meadow lands, aviation can be used for this purpose with great success. In the places where the composition of the grasses is unsatisfactory the meadows have to be ploughed and sown with grasses according to agronomic rules. The necessity for clearing the meadows of stone has already been mentioned above. Other tasks are the expansion of the meadows at the expense of areas covered with forests and marshes of no value and the utilization as haylands of the low banks of reservoirs subjected to periodic flooding.

The northern part of the described territory is particularly rich in forests, where they cover 50–70 per cent. of the entire area. On the rest of the territory the forest areas amount to 25–40 per cent. Least woodland (less than 20 per cent. of the entire area) is found in the Baltic to the south of the Gulf of Finland, with the exception of the Latvian S.S.R.

The general tasks for the entire forest belt of the European part of the U.S.S.R. as regards the transformation of nature of the forest areas are as follows:

(*a*) Improvement of the quality of the stand in the wooded areas by eliminating the unfavourable conditions for the development of forest vegetation;

(*b*) The creation of the best conditions for the reforestation of areas where the forests have been cleared or destroyed by fire.

One of the most unfavourable conditions for the development of forest vegetation is due to the constant surplus of stagnant soil water and the bogging that it engenders. This has to be combated by means of draining the marshy forest areas and regulating the rivers. The entire drainage system can be used for floating timber. These principal measures must be combined with the building of ponds and reservoirs for the erection of small hydro-electric stations, breeding fish and so on.

The second task facing the reconstruction of the forest areas arises from the fact that the cleared spaces are naturally reforested by less valuable trees such as the birch, aspen and the speckled alder. If the young stand is of a mixed composition consisting of valuable and less valuable varieties, then the improvement of the composition of the forest is attained by opening the canopy and thinning the young stand so as to create the best conditions for the development of the more valuable varieties. If the young stand consists mainly of varieties that have little value, then valuable trees such as the pine, the larch, the fir and the oak should be planted on about 10 per cent. of the total area occupied by the young forest. In districts rich in forests where the cutting of timber is done on big solid areas and the felled trees are removed by implements, together with their crowns, then at the time of felling the collection of closed conifer cones must be organized to create a seed fund. Seeds of conifers should then be sown without fail, widely using aeroplanes for this purpose.

In the districts where the forests are few, where they occupy less than

20 per cent. of the area, besides the measures for improving the composition of the forest and the growth conditions of the young trees which usually prevail on the wooded areas of these parts, it is necessary to expand the forests (up to 25 per cent. of the whole of the territory) at the expense of the less convenient arable lands. Afforestation here must primarily be of a water-preserving and shelterbelt nature (the fixing of loose sands, intercepting the surface outflow, protection against the blowing away of the snow, protection of the banks against washing away, etc.). As researches have shown, the larch, particularly the Ural and Siberian varieties which grow rapidly, live long and are resistant to climatic and biotic injuries, should be widely used for afforestation.

The work does not end with the above-mentioned measures for transforming nature in the forest belt. The transition from scattered individual farming to collective farming which has taken place in the Soviet Union, and in recent years the organization of very big collective farms possessing a large fund of arable land have raised the problem of doing away with the scattered nature of agricultural lands—a heritage of the past. The scattered nature of the land limits the efficient utilization of powerful tractors, combines and other up-to-date machines and implements. The collective farms have already done much to amalgamate the lands and merge separate plots of ploughland into big areas; this work however has not yet been completed. The maximum amalgamation of the ploughlands and meadows which involves the clearing of brushwood and coppices, and also afforestation on areas inconvenient for agricultural purposes or which are of particularly great significance for the preservation of water or the planting of shelterbelts are other basic tasks facing the transformation of the forest belt.

The system of land improvement, agronomic and agrotechnical measures described above for the transforming of nature in this forest belt to ensure the progressive rise of the productivity of farming and forest management, is the result of many years of joint work conducted by numerous scientific and practical research institutions in the Soviet Union. The results of these investigations were recently summarized in a collective work 'The improvement of the agricultural utilisation of the lands in the non-black earth belt of the European part of the U.S.S.R.' published by the Academy of Sciences of the U.S.S.R. in 1952. The material of this book has served as the basis of the present article.

THE SOUTH-WEST BORDERLANDS OF THE RUB' AL KHALI

D. G. BUNKER

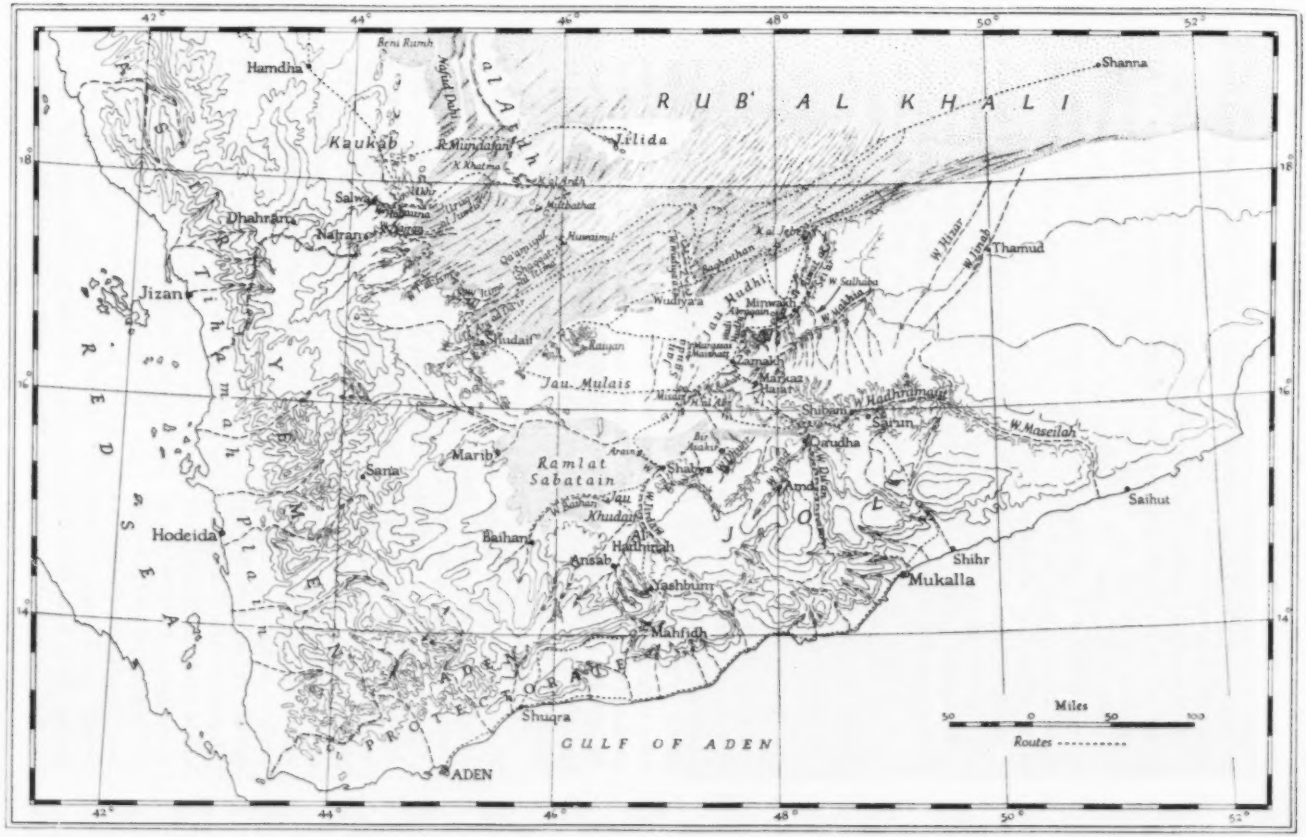
As a result of work carried out for the Desert Locust Survey in south-western Arabia during the past few years, several of the blanks on the map have been filled in and much confirmation has been given to previous travellers' reports. The region particularly investigated has been that which forms the transition belt from the peripheral mountain system to the interior sand desert often referred to as the Rub' al Khali. The area visited has been mapped on a scale of 1:500,000 by means of car-compass traverses tied to astronomically determined positions, all to a general accuracy of 0·1 of a mile. The following notes are intended only to supplement the information contained in those maps which are in process of publication.

The mountain systems

The old crystalline hills of the 'Asir and Yemen, which to the west drop in a series of steps to the Tihamah or coastal plain, are to the east overlain by near horizontal strata of sedimentary rocks of which the oldest are probably the sandstones forming the Kaukab plateau and the newest, excluding recent deposits, are the Eocene limestones of the *jol*, the succession seeming more complete in the north. The peripheral mountain system is in the form of a letter L, where the upright stroke comprises the 'Asir and the Yemen mountains and the horizontal stroke is the *jol* plateau, the division being more or less abrupt along the line of the forty-seventh meridian.

Philby (1938) describes the change between the two sides of the 'Asir watershed as "abruptly from a tropical country to a desert plateau of uniform height of over eight thousand feet (with higher ridges), descending to about six thousand feet at the western end of the Najran tract. It is a sandstone area with occasional cappings and peaks of basalt. Its rugged gorges and valleys have occasional wells and springs, but for the most part it is an abomination of desolation extending north-ward to Dhahran and south-ward to the limit of vision into the still unexplored territory of northern Yemen." Nevertheless there are among the eastern slopes many wadis whose seasonal floods may rush out of the mountainous regions to the inland plain and on into the sandy desert.

The regularity of these floods in the past may be deduced from the extent of the thick layers of silt which mark the sites of past damming and irrigation works in nearly all these wadis. These silt layers often form 20-foot cliffs containing the present watercourses, and occasionally the ruins of the dams themselves may be found. The Wadis Habauna and Najran, besides having silt cliffs, show signs of further re-cutting of their outwash plains. In both cases the outwash plain extends regularly for the first 10 miles from the foothills but during the next 5 miles is eroded by gullies some 3 feet deep which together form a plain at a lower level, only to be re-cut in the same manner.



South-west borderlands of the Rub' al Khali

In those parts visited, three such steps were noted in Wadi Najran and two in Wadi Habauna.

The line of the eastern foothills of the 'Asir and Yemen mountains continues in a curve south-east from Najran through Marib and Baihan to Al Hadhinah, about 14° 30′ N, 46° 50′ E. From here southwards through Mahfadh to the coast the crystalline rocks disappear under the cover of horizontal strata of nodular Eocene limestone which forms the plateau of the *jol*. The western limit of this *jol* continues north-east from Al Hadhinah to the Khashm al Jebel, 17° 30′ N.

At the Khashm al Jebel the plateau has an elevation a little over 2000 feet rising gently south-south-westwards till at 16° N. the altitude is 3000 feet at Sai'un and 3400 by Markaz Hajar and Husn al 'Abr. South of the Wadi Hadhramaut the strata continue to rise until some 40 miles inland from the coast, where an increasing amount of faulting occurs and blocks of the *jol* have been forced to heights of over 6000 feet. Here too begins the volcanic activity evidenced by lava flows and signs of contact metamorphism, with a thin stratum of limestone overlying the igneous rocks (Plate 1).

The wadis of the jol

The deeply incised wadi courses which descend through the *jol* in a series of steps between high cliffs have excited the curiosity of travellers from the earliest times (Plate 2). The Bents (1900) thought that the erosion had been caused by marine action, but the general theory of climatic fluctuations has since suggested that there may have been sufficient rain in the past to have produced the present landform. Fisher (1951) remarks that the feature of the wide upper reaches of the Wadi Hadhramaut would seem to be the result of wadi capture, and it is suggested that this theory can be elaborated to account for the whole pattern of the present *jol* drainage.

The original drainage was north and south from the 6000-foot watershed. There may have been an east–west fault along the line of the present Wadi Hadhramaut which caused the north-flowing rivers each to have a short eastward reach along the line of the fault before continuing north again. One of the south-flowing rivers, the Maseilah, cut back through the main watershed at about 15° 40′ N., 50° 50′ E. and initiated the series of river captures on a line parallel to and inland of the watershed. In this it would have been helped by the existence of a fault line or similar line of weakness, though the absence of such a line of weakness does not materially affect or invalidate the hypothesis. The west–east course of the Hadhramaut–Maseilah system formed in this way dominates the present drainage pattern. The upper reaches of the north-flowing rivers would now have become north-flowing tributaries to the Wadi Hadhramaut, while the lower reaches would have been left headless or formed their own much shallower heads at the subsidiary watershed now created to the north of the Hadhramaut. This is supported by the statement by Thesiger (1949) that "the wadis flowing north from the Hadhramaut watershed are shallow at their heads, in contrast with the north-flowing wadis from Dhufar which begin in deep canyons." Once the north-flowing wadis from Dhufar are compared with the north-flowing wadis from the main watershed, *i.e.* the north-flowing tributaries to the Wadi Hadhra-

1. Thin stratum of limestone (top right-hand corner) overlying igneous rocks, on the west road from Mukalla

2. Part of the jol with the Wadi Hadhramaut, east of Tarim. The cliffs are approximately 1000 feet high

3. A typical town on unproductive land in the Wadi Du'an

4. Part of the "Assoda" scarp seen from the Uruq az Zaza dunes. The scarp can be seen as a black line on horizon level. Vegetation is largely Calligonum comosum, Dipterygium glaucum and Cyperus sp.

maut, and not with their beheaded remnants north of the subsidiary watershed, then the similarity becomes obvious. As would be expected from this theory, the south-flowing tributaries to the Wadi Hadhramaut have heads even deeper than those on the main watershed. Given a short eastward displacement in the courses of the original rivers, then it is possible that the Du'an and 'Amd drainages originally fed into the Hizar and Jinab respectively.

The completion of the present phase of river capture occurred when the headwaters of the Hadhramaut cut right back and out of the western edge of the *jol*, and formed the unusual and almost unique feature of the wide upper reaches in a line from Husn al 'Abr to Shabwa. The headwaters cut back rapidly across the plain which had been formed by the wadis 'Arma, Jirdan, Baihan, etc., and carried all the waters from them down to the Maseilah and the Gulf of Aden, whereas before they had drained towards the Persian Gulf. This capture has left a vast dry plain, the Khudaif–Mulais basin, with dry watercourses up to 2 miles wide. Several such courses may be seen in the Wudiya'a area, and have banks 20 feet or more deep, and floors of heavy fluvial gravels.

A series of levels carried out in early 1951 showed river capture still occurring around Husn al 'Abr. Here short, steep-profiled tributaries to the Wadi Hadhramaut are cutting back into the headwaters of the Wadi Hudhi, which flows north-eastwards past Zamakh with the cliff edge of the *jol* forming its right bank. Hills such as the Misair group have been isolated from the rest of the *jol*, and both Misair and Rubah retain the flat-topped character of the *jol*. The cliff face of Rubah is only some 200 feet high on the north where it descends to the Hudhi, but on the south it drops 500 feet to the Hadhramaut. Levels were also carried out in the Minwakh area and showed the capture of the lower waters of the Hudhi and the waters of the Sibr, Kor, Sulhaba, etc., which had been tributary to it. The point of capture of these rivers by the Aiwat as Sei'ar is at Shasun, about 10 miles downstream from Minwakh

The pattern of settlements

The siting of settlements in the mountain areas is dependent on agriculture with its requirement of a workable tilth and water at a manageable depth. Among the crystalline hills these conditions are best fulfilled at the foot of the torrent course, where the first patches of riverine plain appear. Thus there is a series of settlements from Ranya through Bisha, Tathlith, Hamdha, Salwa, Najran, Shudaif, Marib, Baihan, and Ansab to Al Hadhinah, and all these settlements can be reached by motor transport from the inland plain by driving up the wadi bed. Fenetration upstream of the settlements is frequently difficult as the bed becomes stony and boulder-strewn, and all pretence of riverine plain ceases.

In the *jol* the wadis descend in a series of steps which are caused by strata more resistant to erosion. The horizontal section of each of these steps has retained sufficient silt for agriculture and water is also available. Moreover the vertical cliff faces, sometimes higher than the width of the valleys they contain, cut off the morning and afternoon sun, thereby considerably reducing

the amount of evaporation. Accordingly we find in the north–south wadis a continuous belt of cultivations with hamlets of a few houses every mile and towns about 15 miles or an easy day's walk apart. As opposed to this the cultivations in the Wadi Hadhramaut, which runs west–east, are to be found mainly in belts along the northern and southern sides, the south belt being wider than the north, due to the increasing evaporation and lower water table towards the centre of the wadi.

Except for the hamlets which occur among the fields, the buildings make use of unproductive land, and perch up against the cliff side on the talus slope. This position also carries the advantages of shade together with good siting for defence. Where land is at a premium, villages may be so sited as to become inaccessible even to the draught and load-carrying beasts used in agriculture, and the stables and grainstores are found at the edges of the fields and at the foot of the narrow winding path leading up to the village (Plate 3).

Water for the permanent cultivations of *dhurra* (*Sorghum* sp.), *dukhn* (*Pennisetum typhoideum* et spp.), lucerne and date palm has until the last few years been drawn by man or animal power, raising a leather bag of water by walking down a ramp away from the well shaft. Nowadays greater use is being made of diesel- and petrol-driven pumps, increasing both the yield and the area it is economical to cultivate. The effect of these pumps, which are available on deferred terms, in lowering the water table will be watched with care. New crops such as potatoes, the brassicas, and sugar cane are also being introduced under the agriculture scheme in an attempt to make the Hadhramaut, if not entirely self-supporting, at least less dependent on its "extra-territorial population."

This limitation does not apply to the flood crops which are snatched wherever possible. Throughout the lower wadi systems there exists a complicated network of deflector dams which have the object of spreading the floodwaters over as large an area as possible, and leading a certain part of them into irrigation channels. Many retaining dams have been attempted, but usually unsuccessfully, as the major structure has been an earthwork with only the spillway of durable construction. In the shallow beds of the wadis running north from the secondary watershed there are many small cultivated patches and groups of two or three fortified houses are often situated where camel tracks converge on water cisterns cut into the rock.

The transition belt.

The transition zone between the mountain systems and the sand desert takes a number of forms. North of the Ramlat[1] al Mundafan the Kaukab sandstone plateau overlies the crystalline rocks to the west, and to the east has eroded to become an area of minor plateaus and blocks. Through the wide flat valleys between these minor plateaus runs the main Najran–Dawasir track, roughly north–south in longitude 44° 45′ E. at a general height of a little under 3000 feet. To the east of this track lies the southern section of the Nafud Dahi, running parallel with the road, and rising to a height of 100 feet

[1] Ramla(t): a general name for any sand feature. Thus the Ramlat al Mundafan means literally "the buried sands."

above it. It is a sandstone feature some 25 miles wide and has a covering of loose sand which tends to conceal its structure. However the sand cover becomes so thin along the highest part that the vegetation takes on a reticulated pattern in conformity with the fissure pattern of the sandstone below, suggesting that the ridge is either a shallow anticline or more probably a low west-facing escarpment concealed by the surfacing of loose sand. On the most southerly extension of the Nafud Dahi there are a few parallel dune chains oriented to 220° and 1 to 2 miles in length with a lateral spacing of 1 mile between groups. The slip faces are to the south-east, and the dunes about 20 feet high. According to local information the dunes are more

South-west borderlands of the Rub' al Khali: geological detail

abundant to the north, and the orientation of the Beni Rumh sands is to the north-west, but this area was not visited.

To the east, the Nafud Dahi descends easily to a north–south plain some 10 miles wide and 100 miles long lying at a height of 2600 feet at the foot of the Ardh scarp. This scarp, which is the southward continuation of the Jebel Tuwaiq, is of possibly Triassic calcareous felspathic sandstone overlain by a sheet of Jurassic limestone of great purity but covered by "desert varnish" giving it the appearance of old ivory. The scarp varies from 200 to 250 feet in height and between 19° and 20° N. lies in longitude 45° 10′ E., interrupted in 19° 53′ N. by the Wadi Fau. South of 19° N. the scarp turns to the south-east, loses height due to the east-north-east dip, and reaches 18° 32′ N., 45° 25′ E. The parallel dune chains of the sand desert proper lie on top of the scarp and from 2 to 4 miles back from the edge, with the exception of one line, the Ramlat al Mundafan which, in line with the ends of the other dunes, disappears into a depression of the Ardh scarp known as the Muqta'a al Tuwaiq, 18° 30′ N., 45° 30′ E. and continues, "buried" from sight, out on to the plain at the foot of the scarp. Motor transport can be taken up the

scarp at this point. The general alignment of the dunes is to 245° with the slip face to the north-west. The height is about 70 feet. As the Mundafan sands continue south-west they become divided into two sections by the *'asfal* [1] Wadi Habauna, a flat gravel plain on which no sign can be found of the Nafud Dahi scarp. The northern section continues unbroken to the eastern edge of the Ukhr block, a sandstone feature separated from the Kaukab plateau.

South of the *'asfal* Wadi Habauna as far as Shudaif the character of the transition zone is entirely different. Here parallel dunes reach right across to the foothills of the 'Asir and Yemen mountains leaving at the most a narrow plain but a few miles wide. For upwards of 20 miles from the base of the mountains, isolated granite crags may be found between and among the sand dunes. Driving through this area frequent detours have to be made out into the sands or in among the foothills to avoid the barrier formed by sand meeting hill. To pass the south-western end of the 'Arq ad Da'ir in 1952 necessitated a journey 6 miles further into the foothills than that recorded by Philby in 1936.

Shudaif marks the southern limit of the Rub' al Khali sands, and from here south-east stretches a vast triangular area of plains bounded to the north by the sands, to the east by the cliff wall of the *jol*, and to the south-west by the Yemen mountains. It has an area in the order of 150,000 square miles, and is divided into three sections, the Jau [2] Mulais, the Jau Khudaif and the Jau Hudhi by the Ramlat Sabatain and the Sauda scarp, which runs west and north respectively from Husn al 'Abr. The process of formation probably took place in three stages, of which the first was the planation of the archaean rocks before the deposition of the sedimentary strata. The second was the removal of this sedimentary cover by north-flowing wadis which were constantly forced against their eastern banks by the east-north-east dip of the underlying rock surface. Two river courses may still be seen doing this, the Hudhi cutting back the *jol*, and the abandoned course by Wudiya'a (see p. 423) which cut back the Sauda scarp. The third stage is the present one of arid erosion, where on the Jau Mulais the igneous protrusions are disintegrating by exfoliation down to a base level where they become protected from the great diurnal temperature changes by the sands and gravels of the desert floor, and on the Jau Hudhi above the Sauda scarp wind erosion is making the surface more and more smooth and level.

The Jau Khudaif and the Jau Mulais together form the Khudaif-Mulais basin referred to above (p. 423). The Jau Mulais is an area of quartz gravels, covered in some places by thin sheets of sand with areas of rock protruding from a few inches to a few feet. A few larger plugs and dykes form conspicuous hills such as the Raiyan group, which is in the form of a series of lines radiating from a point about 16° 30′ N., 46° 10′ E., the granite hills rising sheer from the plain made from their own disintegration. The Jau Khudaif lies to the south of the Jau Mulais and is divided from it by the Ramlat Sabatain. There is a greater cover of sand than on the Jau Mulais,

[1] 'Asfal: the lower reaches and outwash plain of a wadi.

[2] Jau: literally a wide valley here becomes applied only to these extensive plains formed by the merging of many watercourses.

5. Sandy shaqqa bearing Aristida plumosa and Calligonum comosum. These shiqaq extend for hundreds of miles between parallel dune chains, and vary between a half and two miles in width

6. Dune chains by the neolithic site in the Shaqqat al Khareitah. The dunes run to the south-west and the photograph was taken looking north

7. Dune chains north of the Khashm al Jebel. The shaqqa is about half a mile wide

8. Some of the dunes across the shaqqa floor of sand, about 100 miles west of Shanna

and besides the granite foothills to the south-west there is a line of hills formed by salt domes along the foot of the *jol* to the south-east. In this area too may be found lignite deposits and occasional volcanic craters.

The sands of the Ramlat Sabatain lie east–west south of the 16th parallel, and are completely separate from the sands of the Rub' al Khali. In the west, where they lie against the Yemen hills, they measure some 50 miles in width from north to south. To the east they taper to a width of about 10 miles where they enter the Wadi Hadhramaut, and then lie within the wadi as far east as Qa'udha with isolated sections even farther east by Shibam and Sai'un. Near Baihan and near Shabwa the orientation of the dunes is to 290°, with the slip face southwards. Near Shabwa this direction has been used to give an easy crossing from Nasar to Arain, and between the dunes may be found a well marked camel track which was possibly part of the old incense route. South of al 'Abr the dunes lie at 230° and from here curve in a large arc east and south-east until they run almost due south to near Bir 'Asakir. From the east–west section another group of dunes breaks off to run in a similar curve south into the mouth of Wadi Dhuhr. Farther east the alignment is east–west and south of Qarn Qaima there is a reticulated area of overlapping crescentic dunes about 8 feet high and with their slip faces west.

Many wadis from the Yemen hills run into the western section of the Ramlat Sabatain and are dissipated within the sands, but the Wadi Baihan forces its way through the sands in a series of deep silty channels between the dunes which are here fixed by bushes of *arta* (*Calligonum comosum*) and runs out on to the Jau Khudaif. By using this wadi, Baihan can be reached from the Wadi Hadhramaut and also from Aden by the new route from Mahfadh, which makes use of the Yashbum gorge and the line of discontinuity between the crystalline hills and the *jol*.

North of the Ramlat Sabatain, the Jau Mulais is limited to the east by the Sauda scarp. This scarp, which is of sandstones similar to those of the Karoo and possibly of Triassic origin, runs north from near Al 'Abr and includes the hills of Murassas, Maishatt, Wudiya'a, etc. It gets its name Sauda, literally "the black," from its covering of hardpan and pebbles heavily impregnated with ilmenite (Plate 4). Its position marks the westerly limit of limestones, both Jurassic and Eocene, remnants of each of which, much confused with bands of contemporary sandstones, have been found near Wudiya'a. The whole of the Sauda area is covered with a network of intersecting animal tracks converging on salt-licks, proof that the region was once much more prolific of wild life.

East of the Sauda lies the Jau Hudhi, an undulating sand plain whose low hill features may easily be correlated with past drainage patterns. The larger of these hills sometimes bear fragmentary remains of limestone capping in the form of small boulders. From the air distinctive vegetation patterns have been seen near Zamakh. They consist of parallel lines some 30 yards apart running north-west to south-east. There is also one west-flowing tributary from this area to the abandoned watercourse at the foot of the Sauda scarp.

At the Khashm al Jebel, 17° 30′ N., 48° 17′ E., the Jau Hudhi ends in a sharp point at a height of a little over 2000 feet, being limited to the east by the cliff face of the *jol*, here about 120 feet high, and to the north by the first

dunes of the Rub' al Khali. East of the Khashm al Jebel for over 50 miles to the mouth of Wadi Hizar the sands lie in contact with and to some extent overlying the low northern outcrops of the *jol*. These outcrops are in the form of flat-topped mounds covered with coarse pebbles of reddish marl with some thin sheets of limestone. East of Wadi Hizar the transition zone takes a further form as the outliers of the *jol* run in a line south of east and the sands in a line north of east, leaving a widening floor of gravel and desert marl. The plain is about 30 miles wide near Thamud and is reported by Thomas (1932) and by Thesiger (1946) to continue east to the Jiddat al Harasis.[1]

The south-western sands

The area of sands visited has been to the south of the 20th parallel and west of the 51st meridian. Throughout the whole of this area the sand pattern is one of parallel dune chains oriented generally from east-north-east to west-south-west and separated by long strips of flat desert floor known as *shiqaq*[2] (Plate 5). The tails of these dunes lie among the Yemen foothills and several crossings of the dunes have been made, up to 150 miles from the hills. The twenty or thirty southernmost dunes have been traced some 400 miles east to the vicinity of Shanna. In addition a large part of the area has been seen from the air.

The northern section of the Mundafan sands and the Ardh escarpment has already been described (p. 425–6). The southern section of the Mundafan sands are oriented to 205° and this orientation continues south through the 'Uruq al Juweis while other dunes break away to the north at an angle of 220°, parallel to the dunes of that section of the Mundafan which lies to the north of the *'asfal* Wadi Habauna. The slip faces of all these dunes are to the north-west.

South of the Mundafan sands the Ardh escarpment reappears running south from 18° 25′ N., 45° 27′ E. to the Khashm Khatma and then south-west losing height and disappearing into the desert floor at the Khashm al Ardh, 18° 01′ N., 45° 42′ E. This reappearance of the scarp breaks the continuity of the dunes which lie parallel to and south of the Mundafan sands, and leaves sand-free areas both on top of and at the foot of the scarp as with the northern section of the Ardh. A few outcrops of the Ardh occur southwards among the dunes, but do not break the continuity of the dune lines. In particular may be noted the Mutbathat group among which may be found traces of the old course of the Wadi Najran, and the Huwimil group at 17° 30′ N., 46° 00′ E. The final trace of the Jurassic limestones occurs at Abraqain near Wudiya'a.

Dune chains from the Khashm al Ardh may be traced south-west to the area of the wadi Taiyyibat al 'Ism and north-east to the Jilida plain. There is a well-marked motor track made by hunting parties leading to the Jilida plain from Najran via the *shiqaq* between these dunes. By the Khashm al Ardh the dunes are oriented to 220° with the dunes half a mile apart and the

[1] Later journeys (1953) have shown, that at least as far east as the mouth of Wadi Rama, this plain is divided into wide basins by lines of low hills running north from the *jol* to the sands.

[2] *Shaqqa*, pl. *shiqaq*: the "valleys" between parallel dune chains (*'urug*).

slip faces to the north-west. Near the Taiyyibat al 'Ism the orientation is to 250° with a well marked line of riders at 215° some of which extend over the *shaqqa* floor giving a reticulated pattern. The slip face here also is to the north-west.

South of the Mutbathat as far as the Shaqqat al 'Itima, *i.e.* the *shaqqa* into which the Wadi 'Itima flows, lie the Qa'amiyat sands. These dunes, with a height of over 200 feet, are the highest dunes of the south-west Rub' al Khali. They are oriented to 220° with no pronounced slip face, and due to their width the *shiqaq* between them are always narrow and frequently eliminated. They carry riders at 210° which have the slip face to the south-east.

South of the Shaqqal al 'Itima and east of the Sauda scarp which penetrates 30 miles into the sands there are two distinct orientations of the dunes. The easterly section, which lies back from the foot of the scarp, consists of about sixty dune chains less than a mile apart and generally oriented to 245°. Along a distinct line between 17° 15′ N., 45° 45′ E. and the Raiyan hills these dunes coalesce in groups to form only twenty-five dunes oriented to 225°. The slip faces of all these dunes is to the south, and there is no distinct line of riders. A large number of neolithic flints were found at 17° 12′ N., 45° 55′2 E. (Plate 6).

At the northern tip of the Sauda scarp, where it sinks into the desert floor, both floor and scarp are concealed by small south-west facing crescentic dunes 4–6 feet high. East of the Sauda the sands lie back as is the case with the Ardh scarp, but the six most southerly dunes of the sand desert approach to within 2 miles of the top of the scarp. North of them lies an area of sand sheet, the Bagheithan plain, with a few scattered dunes oriented in 250°. The plain may be traced some 20 miles east, and the dunes become more abundant and regular, until by 47° 45′ E. the full pattern of parallel dunes with intervening *shiqaq* is redeveloped (Plate 7). The dune line about twentieth from the south was followed eastward from here (Plate 8). In 17° 50′ N., 48° 10′ E., there is a distinct change in orientation from 252° (to the west) to 244° (to the east), which may be correlated with a more gradual curve through the same range made by the dunes to the south near the Khashm al Jebel. The orientation of the riders is 10° greater than that of the dunes, and the slip faces to the south. For the next 80 miles east there is a series of minor direction changes always between 237° and 243°. In the area about 19° N., 50° E., the *shiqaq* floors become broken into windows by layers of sheet sand perpendicular to the general line of the dunes, and during the next 30 miles east these sheets take a more and more pronounced form till they become as high as the original dune lines, and the straight lines of *shiqaq* become confused in an area of reticulations.

A small area of dune massifs exists near the Khashm al Jebel, occupying the narrow triangle between the most southerly dune and the edge of the *jol*. The massifs lie on the nodes of a hexagon net and do not continue east of the mouth of the Wadi Hizar except for a few isolated examples known as "qa'id" on the gravel *jau*. The slip faces of all these massifs are to the south-west.

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THE GEOGRAPHICAL PATTERN OF POPULATION CHANGES IN ENGLAND AND WALES, 1921–1951

E. C. WILLATTS AND MARION G. C. NEWSON[1]

DURING THE LAST thirty years the vast and very complex changes which have been taking place in the economic and social life of the country have naturally been reflected in local fluctuations, and in trends of movement, of population over various parts of England and Wales. The publication of the results of the latest census will facilitate the study of many aspects of these and other matters. But without waiting for the full census results it is possible to review the main trends in the pattern of population changes. This paper is largely a sequel to the publication of, and is essentially an analytical study of the facts revealed by, the series of national maps on the scale of 1/625,000, or 10 miles to the inch, dealing with changes in population in the periods 1921–31, 1931–39 (already published) and 1939–47 (in the press).[2] These cover the period between the two World Wars and that of the late war and the subsequent period of resettlement. The issue of the 1951 data enables thirty years to be reviewed, but by only studying period by period are many important trends revealed.

The study is inevitably constrained by the limitations of its data, of which the most serious is that the statistics necessarily relate to local authority administrative areas. These, numbering 1439, are not homogeneous, and because the boundaries of urban areas have not been automatically adjusted when town populations have "overspilt" into adjacent Rural Districts, it often happens that an increase in the population of such Rural Districts may mask a decline in their really country parts. In 1951 the civilian population of England and Wales was 43,270,000, of which 81·1 per cent. was urban in the sense of living in Boroughs or Urban Districts, but if we were to include the outward growths of these towns which are still in Rural Districts the population which is urban or suburban would probably constitute at least 85 per cent. of the whole.

The present pattern of population distribution is only the latest phase of a series of movements commencing with the Industrial Revolution. The developments which it brought in the easy transport of coal, in economies in its use, and for alternative sources of power have favoured the growth of centres not on or near the coalfields. This trend which was already marked before 1921 has since continued, population being strongly attracted from the older centres on some of the earliest worked coalfields to areas of more recent industrial expansion, chiefly in the Midlands and the South.

[1] The views expressed in this paper are those of the authors and not necessarily those of the Ministry of Housing and Local Government, in which both are members of the Research Staff.

[2] The authors wish to express their appreciation of the help of many colleagues in the Ministry of Housing and Local Government whose work, both research and cartographic, has contributed to the preparation of this paper.

Before the war the country's annual rate of increase of population was slowly falling, from 0·6 per cent. in 1921–31 to 0·5 per cent. in 1931–39. The war years naturally showed a steep decline—to 0·2 per cent.—but in the four years from 1947–51 the effect of the higher birth rate immediately following the war, of new immigration and of demobilization has been an acceleration of the average annual rate of growth of the population to 0·9 per cent.

Population of England and Wales (in thousands)

	Resident populations					*Civilian populations* *	
	1921 *Boundaries*	1931 *Boundaries*		1947 *Boundaries*		1947 *Boundaries*	
	1921	1921	1931	1931	1939	1947	1951
Outside Greater London:							
In County Boroughs	12,040	12,300	12,700	12,800	12,840	12,680	13,020
In Municipal Boroughs and Urban Districts ..	10,630	10,750	11,230	11,920	12,570	13,300	13,760
In Greater London Conurbation ..	7,410	7,470	8,070	8,240	8,750	8,090	8,310
In Rural Districts	7,800	7,370	7,990	7,030	7,300	7,710	8,180
Total, England and Wales	37,890	37,890	39,990	39,990	41,460	41,790	43,270

* The differences between Resident and Civilian populations at 1939 were not large enough to invalidate the broad picture shown by these figures.

The table shows the total population at the four dates which begin or end each of the periods we examine. Before the war the population in urban areas was increasing, despite a continuous overspill into rural districts. This overspill has only lessened the urban population in the case of large towns, notably the county of London. From 1939–47 however the population of Rural Districts increased at the expense of Urban Districts, at a time when house building was almost at a standstill and must largely be attributed to factors operating during and after the war. Since 1947 the increase in the proportion of dwellers in rural districts has continued, though at a slower rate, and for a variety of reasons, which will be discussed later.

Changes in Rural Districts

The growth of industrialism gave a strong impetus to rural depopulation. Rural industries were gradually replaced by urban industry to which rural workers migrated. Low wages in agriculture encouraged workers to seek better-paid urban employment though in some cases a greater efficiency in farming was both the cause and effect of rural depopulation. Population losses from Rural Districts (Fig. 1) were however relatively gradual between 1921 and 1931, and only exceeded 5 per cent. in upland Wales, northern England, parts of Wiltshire and in Suffolk. From 1931 to 1939 they were more widespread, and in Wales, northern England, and Devon, more acute. In this period the east, chiefly Lincolnshire and East Anglia, was recovering from its period of maximum depopulation but the west and north were only then experiencing their heaviest losses.

It should be re-emphasized that certain Rural Districts contain a suburban

overflow from adjacent towns which may offset or diminish, both socially and economically, the effects of a loss of population from the rest of the Rural District. The more truly rural areas, often the most remote from modern lines of communication, have felt the effects of population loss over the longest

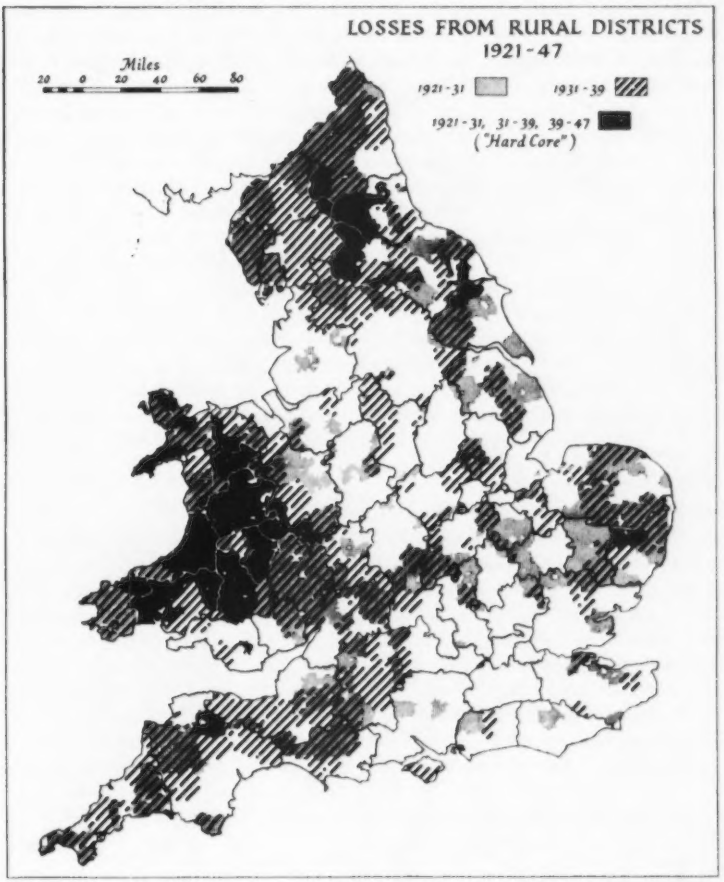


Figure 1

periods. For in the more remote districts there is seldom a satisfactory alternative occupation to agriculture or small scale rural industry, both so vulnerable to outside competition, nor has there been a compensating influx of urban occupied people into these less accessible districts.[1]

[1] For a fuller discussion of this and related matters see S. E. W. Vince, "Reflections on the Structure and Distribution of Rural Population in England and Wales, 1921–31." *Transactions and Papers*, no. 18, Institute of British Geographers, 1952.

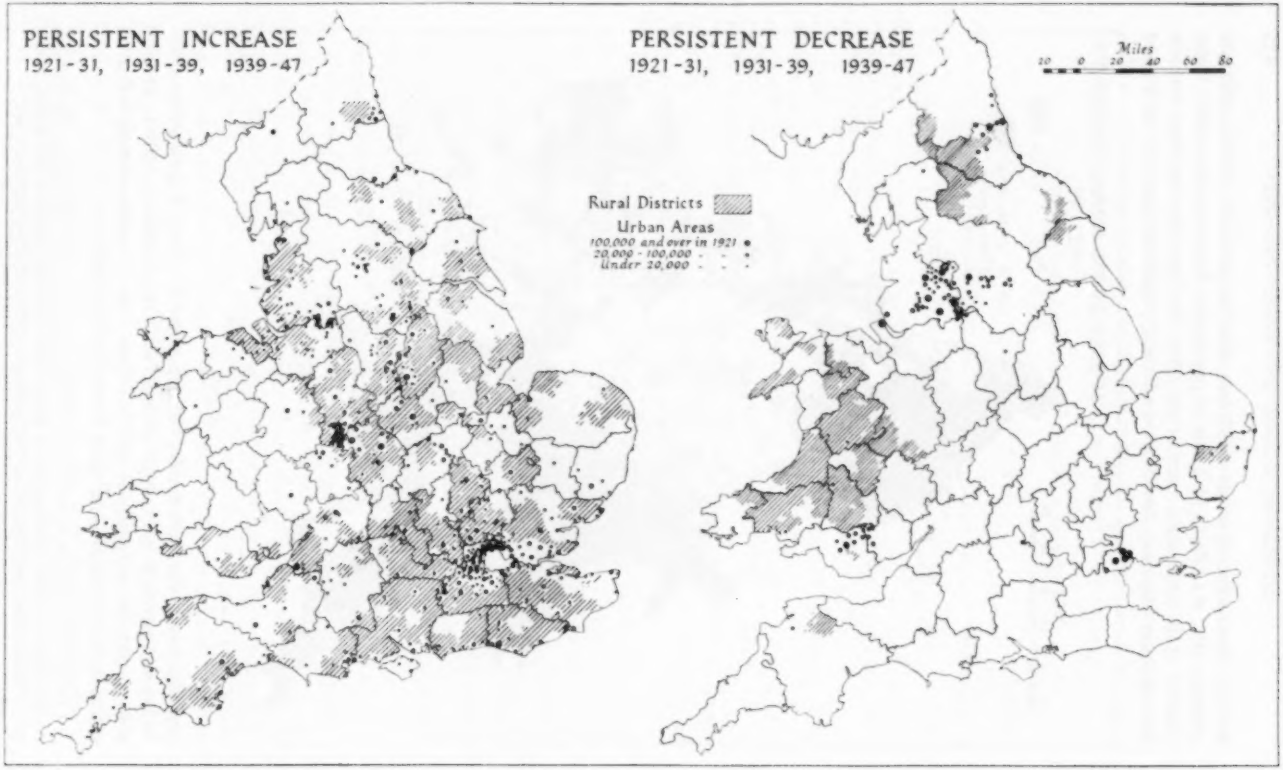


Figure 2

Figure 3

Areas of persistent increase

Figure 2 shows that many of the rural tracts which have continuously increased are adjacent to large urban and industrial areas and their pattern suggests the "Axial Belt" to which Professor Taylor drew attention before the war.[1] Rural increases cover much of south-east England; a large tract of country stretching from south Staffordshire and Warwick north-eastwards to the Humber; and certain coastal areas—North Wales, west Lancashire, Hampshire, south Devon. In these last two areas the growing number of retired immigrants has often masked losses from the native rural population. There is also reason to believe that the population of newer suburban areas (often contained in Rural Districts) is younger than those of the town centres and therefore has a higher rate of natural increase. On the other hand, in the Fens and some smaller areas in different parts of the country, an actual rise in the agricultural population has occurred through an intensification of farming on highly productive land.

While rural increases are usually associated with increases in adjacent towns, it is significant that in some districts, *e.g.* rural Wales, the South-West and the North, towns have increased without a corresponding trend in the rural districts. It suggests a tendency to concentrate in the towns some of the industries and services which were formerly in the villages, without a compensating overspill of adventitious population. It may mean no more than a "retreat to the local towns," a change in the local equilibrium.

Areas of persistent loss

Figure 3, showing towns and Rural Districts which have persistently lost population is one of particular significance to all who are concerned with the economic and social implications of changes. There are three main types of area which failed to maintain their populations in each of the three periods between 1921 and 1947 and these we have defined as the "hard cores." First there are the remote and often high districts of rural Wales, north Devon, the north Pennines, parts of the north Yorkshire moors and the Vale of Pickering, and part of north-east Suffolk. Secondly, the older industrial areas on the coalfields of South Wales, the North-east, the textile areas of Lancashire and Yorkshire, and part of Merseyside. Thirdly, the county of London and some adjacent boroughs. London County has been losing for over forty years and has lost over a million perople since 1931.

In addition, some isolated towns, especially coastal ones, have been steadily losing.

Areas of new loss

In relation to the "hard cores," it is instructive to examine the areas, shown in Figures 4 and 5, which have lost continuously since 1931 and since 1939. The most important fact is that there are few such areas. Of those which have lost since 1931 the majority are on the fringes of the "hard cores", such as rural areas in Wales, Yorkshire, Durham and Westmorland, and Exmoor. Most of the towns whose populations started to decline in this

[1] E. G. R. Taylor, "Discussion on the Geographical Distribution of Industry," *Geogr. J.* 92 (1938) 22

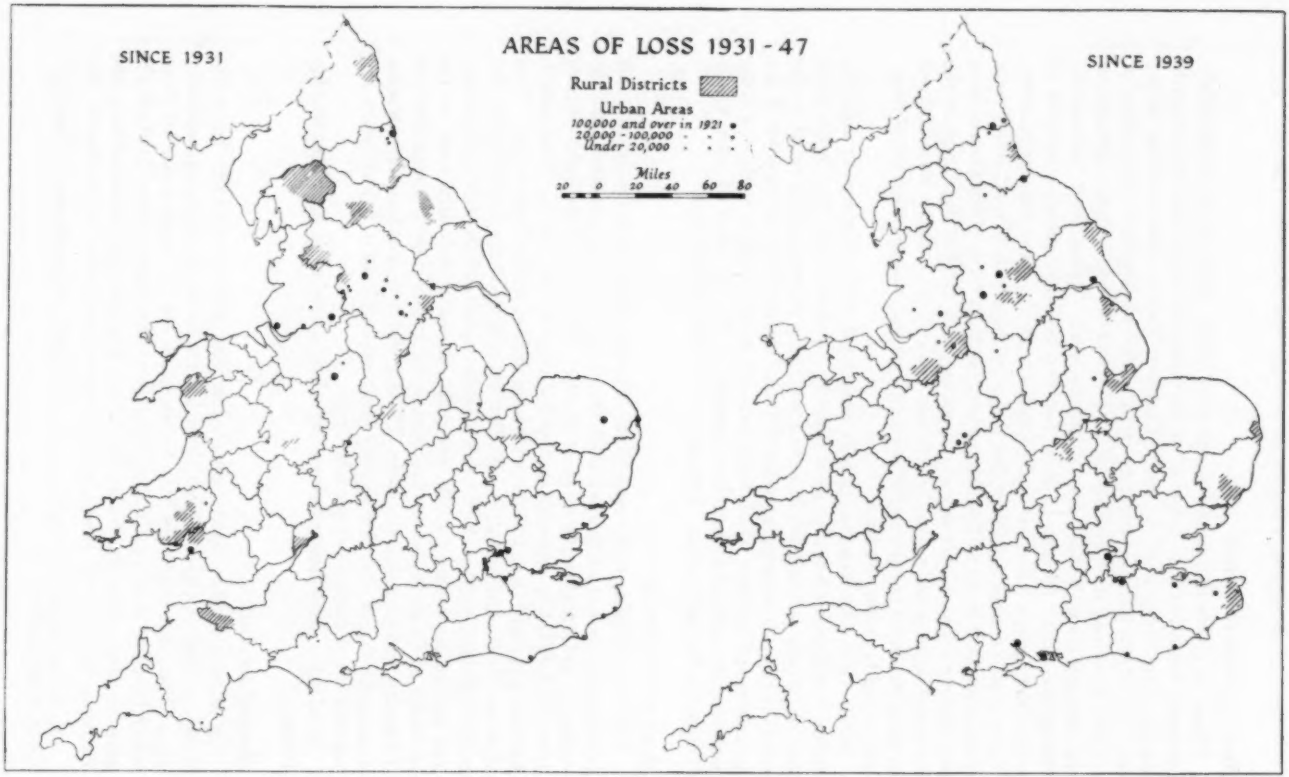


Figure 4

Figure 5

period have been losing only to neighbouring areas, either Rural Districts or suburban or satellite towns. For example, population from the nine or ten boroughs just beyond the London County boundary has been moving outwards to the newer suburbs of the metropolis. Manchester, Stoke-on-Trent and Norwich are in a similar class.

New losses, since 1939, are different in that they show less tendency to be a fringing extension of the old "hard cores" except in Lancashire, the West Riding, the North-east and the fringe of the County of London.

A number of coastal towns in south and south-east England between Southampton and Clacton showed new losses due to war disturbances. Some of the losses in both periods since 1931 have been in areas of extractive industry such as the older parts of the Yorkshire coalfield, the western part of the South Wales field and the Forest of Dean. Others are due to lack of industrial resilence, as in the boot and shoe area of Northamptonshire.

Areas of recovery, 1939–47

These are the areas which were formerly losing but which are again increasing, and in the great majority of cases, since 1939 (Fig. 6). Such areas have extended over much of rural England, but in rural Wales are chiefly confined to the towns and to some coastal areas. The general tendency is for the recovery to lie to the east, west and north of the central areas of persistent increase, including much of the newer parts of a widening axial belt. They are largely a result of a post-1939 movement away from the more congested urban areas to districts of lower density in rural areas, a trend previously mentioned. That movement is very dependant on good transport facilities, so that recovery has not advanced into those regions from which access to the nearest large town is still too difficult. It is noticeable that although there has been some recovery in areas fringing regions of persistent loss there was none in central London, various coalfields, *e.g.* most of the upper valleys of South Wales, north Lancashire, north Durham or the rural "hard cores."

Changes, 1947–51

The Ten-Mile maps of Population Changes carry the story only to 1947. The period of four years between then and the census is too short for us to be certain that some of the changes it saw will not prove to be anomalous or very temporary, of a type which may have occurred in parts of previous periods, but which would have been masked by the trends of a decade or thereabouts. Nevertheless, those years comprise the real post-war period in which the numbers of civilian population have returned almost to normal, war-time influences receded and house-building, virtually at a standstill during the war, was resumed. It will not have escaped the attention of many that the year 1947 also saw the passing of the momentous Town and Country Planning Act, although it would be quite wrong to attribute all subsequent changes to the influence of physical planners!

The preceding period (1939–47) has been seen to be one of widespread recovery especially in rural areas and those adjacent to the "hard cores" of persistent loss. Since 1947, as shown in Figure 7, this tendency has continued. How much of it is the result of the temporary rise in the birth rate after the war cannot yet be seen, but it is clear that territorially there has been a

continued spread of the recovery, reducing the size of most of the former "hard cores" and virtually eliminating those of Suffolk and north Devon.

Most of the larger towns showed an increase. The conversion of large houses into flats, the rebuilding of war-damaged areas and the erection of new dwellings facilitated the inflow of population into towns, especially

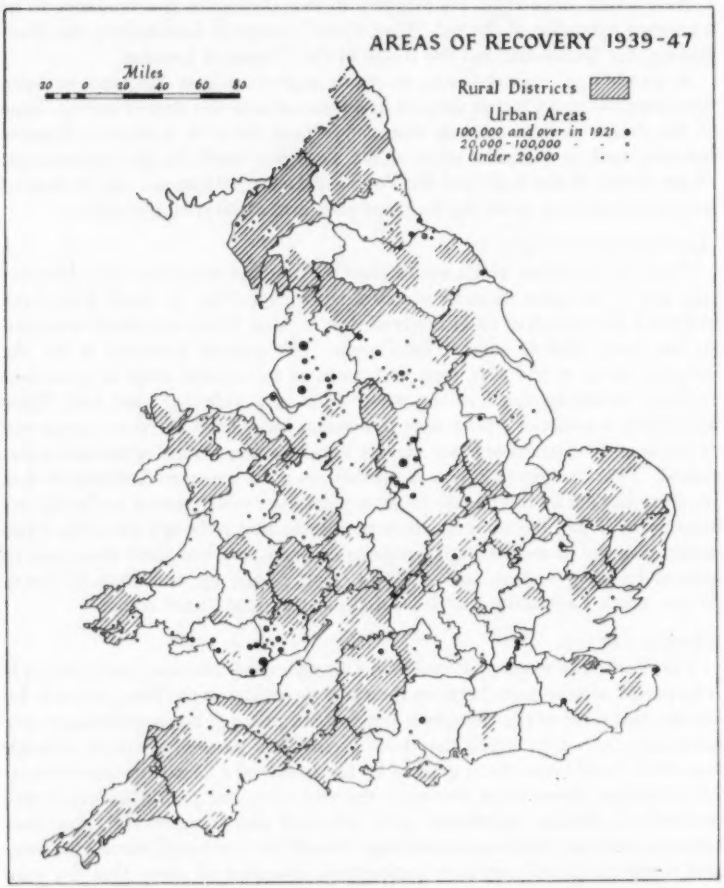


Figure 6

London. As the inset to Figure 7 shows, most of the Metropolitan Boroughs within London participated in the increase while the suburban ring of towns continued its former trend of persistent gain, and the same tendency is found, with markedly high rates of increase, in the Metropolitan Green Belt, and adjacent Rural Districts, all areas with good public transport services. Such trends of persistent gain are continuing elsewhere where conurbations and

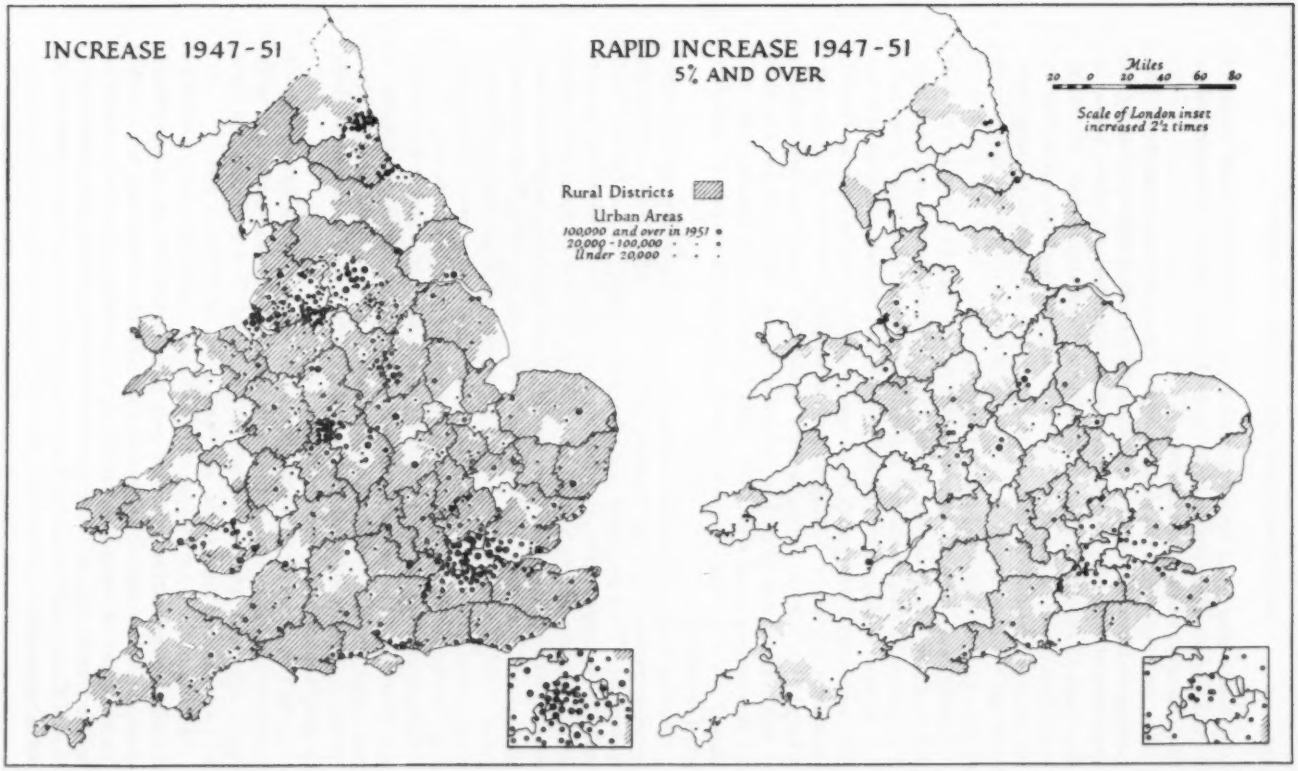


Figure 7

Figure 8

large towns have again been overspilling into neighbouring small towns or Rural Districts. This is noticeable in the Black Country, Tees-side and on the fringes of industrial Lancashire.

The recovery which was such a marked feature of many areas in the previous period was, as we have said, maintained and continued. Among the rural areas so increasing were north-west Northumberland, where forestry is important, Cumberland, most of East Anglia, Northamptonshire, the Welsh borderland, Dorset and parts of south-west England, and some areas closer to the main centres of population, including south Leicestershire, west Kesteven, and Gloucestershire. But, as will be shown later, some of the recovery in 1939–47 is now seen to have been temporary.

As there was an overall increase in the period 1947–51 of 3·5 per cent., it was natural for a large number of districts to show increases of over 1 per cent. The pattern of those with increases exceeding 5 per cent. (Fig. 8) is therefore of more significance. The concentration in the outer London area has been mentioned, the growth of certain industrial centres such as Cardiff, Gloucester, Coventry, Nottingham, Grantham and Scunthorpe is not surprising. Two features are particularly remarkable. One is the large number of small rural towns which have increased rapidly, and at a higher rate than the surrounding rural areas. The other is the complete absence from this class of any of the large or medium towns in the textile districts of Yorkshire and Lancashire.

The slight extent of actual decreases, in a period of generally rapid increase, is not surprising, but their location, in both town and country, is obviously noteworthy. They are shown (Fig. 9) against a background of the old "hard cores" of persistent rural loss, which are seen to be continued only in parts of north Yorkshire and the heart of Wales. Elsewhere new increases have spread over almost all the areas of former loss. But it should be emphasized that these short-period increases have done little to offset the preceding long-continued losses. This is equally true of those urban areas in which there has been a slight recovery in the last four years, and there remain still a significantly large number of towns which have been losing population, notably in the Development Areas of the North-East and South Wales and in Lancashire and Yorkshire. The outward movement from older suburbs of London is again apparent. There have also been small losses from many of the seaside resorts of the west and south-west coasts and from inland spas, some of them former reception areas for evacuees.

In the rural areas it seems that some of the recovery of the 1939–47 period was temporary, as in parts of the South-west, east Carnarvonshire and north Northumberland, where new losses have occurred. It is significant that these are found around some of the old "hard cores" of persistent loss.

In parts of the tract between the Lincolnshire coast and south Leicestershire and mid-Northamptonshire, new population losses are discernible in about nine areas, most of which adjoin areas which revealed new losses in the preceding period, suggesting a tendency to instability in the tract. It may be due, at least in part, to the attraction provided by locally expanding centres such as Corby and Peterborough which have shown considerable increases in the same period.

The part played by migration

Net changes in population, especially at a time in human history when there is a marked tendency towards the prolongation of human life, tend to conceal very significant movements due to migration. For that reason, in addition to the maps showing total changes, *i.e.* the net result of births,

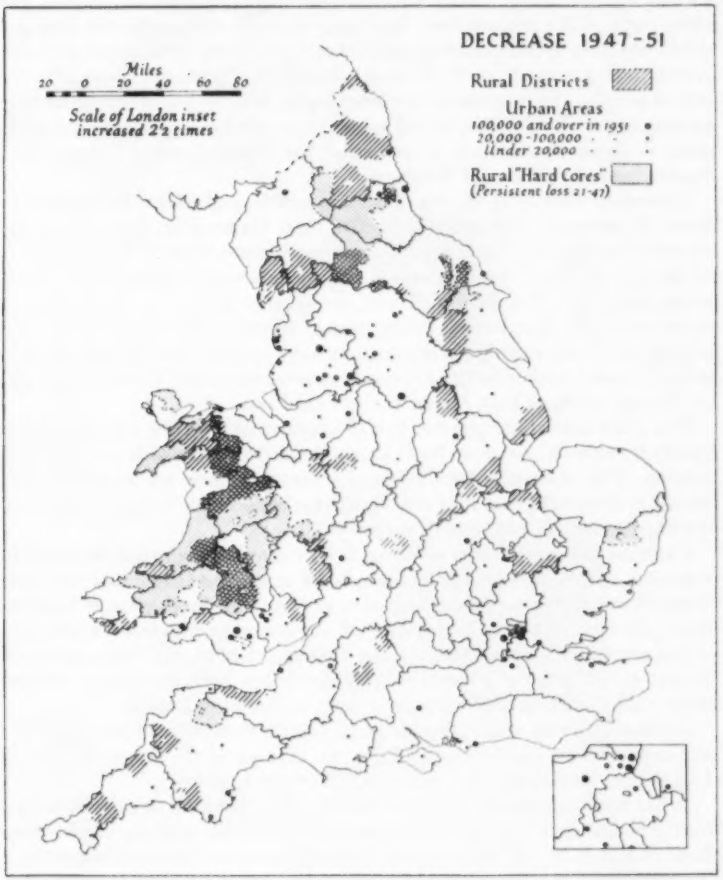


Figure 9

deaths and migration, for 1921–31, 1931–9 and 1939–47, the complementary maps of changes due to migration were prepared. The patterns they reveal are often very different from those of total change and are, of course, much more critical indicies of social and economic trends. The differences between the two sets of maps vary according to the rates of natural increase. In much of northern England the relatively high rate of natural increase (average 5 per

cent. per decade) tends to offset the effect of migrational loss, save in the industrial areas on the coalfields and in the northern Pennines. In the south of England, where rates of natural increase average 2 or 3 per cent. in a decade, migrational change and total change show a marked similarity. Figures 10 and 11 are only a summary of trends which are shown in the various 10-mile maps. Figure 10 shows, as might be expected, beyond the older parts of the metropolis a large area of south and south-east England which has been gaining continuously since 1921. Parts of the coast of south Devon and Cornwall, with obvious residential attractions, especially for retired people, have also shown prolonged gain, but the few other moderately extensive areas in this class are all suburban or rural peripheries of conurbations or large towns such as surround the Black Country, Merseyside, Nottingham, Leicester and Norwich.

Extensions since 1931 are not very considerable, and tend to be adjacent to those of persistent gain since an earlier date. Gains since 1939, when the merits of country life began to be unexpectedly appreciated by large numbers of people, are much more extensive and include many remote areas. Such areas, where gain has succeeded loss, are broadly similar in distribution to those previously described as being areas of recovery when considering total population. They include, in the north, a large arc from the Scottish border, through west Cumberland and south Westmorland to the Vale of York, and in the east, much of East Anglia, but not the Fens.

The other side of the picture, that of migrational loss (Fig. 11), is one that pleads for serious attention, for it shows the areas from which population is moving. This is usually because employment prospects are so much more attractive elsewhere than they are locally that emigration, normally of part of the important virile element, is worth while.

Continuous migration has occurred from remote or high rural areas; from a number of the older industrial areas, being at an especially heavy rate from South Wales and parts of the North-east, and from the inner areas of London, especially from the East End. Some of the lowland agricultural areas from which migration has been taking place, such as the Fens, Wiltshire and south Dorset are virile areas whose total population has been increasing, because their rates of natural increase exceed those of loss by migration.

Areas of renewed or new loss are less extensive than those of persistent loss and in general are adjacent to the latter, for example in the industrial areas of Lancashire, Yorkshire, Derbyshire and Nottinghamshire.

It has not been possible to undertake detailed mapping of migration data for the period since 1947, but evidence is available from National Registration Returns and H.M.S.O. has published a special study on "Internal Migration." The One Per Cent. Sample report of the 1951 Census contains a great deal of information on the volume, origin and direction of migration which has occurred during the lifetime of the enumerated population, but not otherwise related to specific periods.

Certain points are clear. For example, the widespread gains in total population shown to have occurred after 1947 are not to be accepted by themselves as indicating established trends of recovery, for in many areas the total gain which succeeded previous loss masked a significant underlying loss by

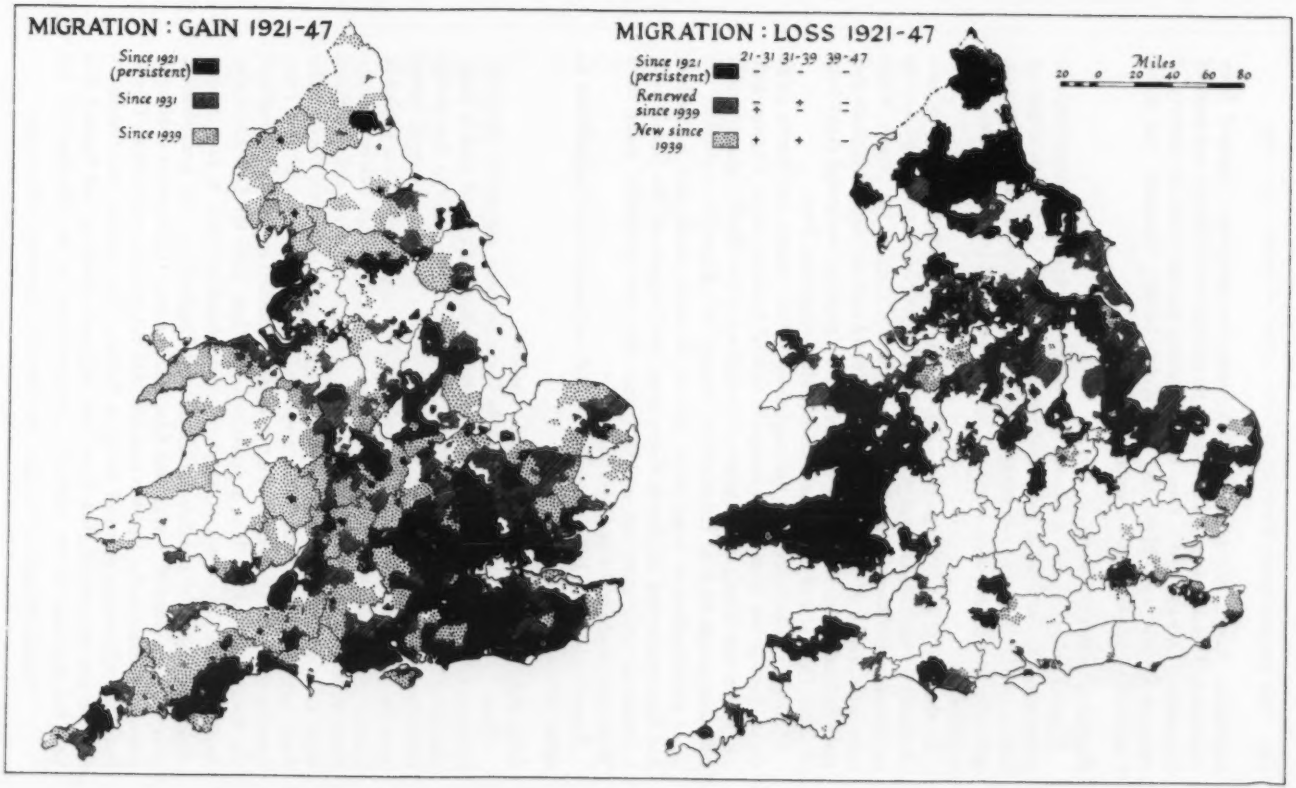


Figure 10

Figure 11

migration. Again, the migrational increases in south-east England have continued. In some parts, as in east Anglia and the east Midlands and parts of Lancashire and Cheshire, they have extended, but the trend of recovery of 1939–47 in the west Midlands, the Welsh border, Cornwall and north Cumberland has not been maintained.

Regions of persistent change

Figures 12 and 13 are an attempt to present, with essential generalizations, a regional summary of the pattern of persistent change, *i.e.* persistent gain or loss in *each* of the three main periods since 1921. Areas which have fluctuated, generally with decreases followed by increases (*i.e.* recovery areas), are stippled.

In the case of total change (Fig. 12), regions of persistent increase include all of south-east England except central London; the Midland triangle and its northward extension; other largely urban tracts such as the North Wales coastlands, much of Merseyside, around Bristol and the Severn Estuary and parts of Yorkshire. Somewhat different is the popular residential coast-land of south Devon, and again the agriculturally prosperous Fens.

Figure 13, which presents the migration picture, shows continuous gains everywhere in the South-East except in central London, lower Thames-side and north-east Kent; in the southern periphery of the Black Country and a belt northwards to west Lincolnshire; around or adjacent to several of the other conurbations or large cities, Bristol, Norwich, south-east Lancashire and Merseyside and the North Wales coast; and in parts of the South-west. Continuous emigration has occurred from the older industrial areas, rural Wales and north and east England.

Recovery has been largely confined to mid- and south-west England and to some northern rural areas.

Long-distance migration and the lure of London

There is ample evidence of much short-distance migration especially between adjacent authorities. There is also evidence of a good deal of long-distance migration. A study by Miss Newton and Mr. Jeffery [1] has shown that over half the gross movements to and from a number of sample towns were for distances exceeding 40 miles. Long-distance migration is probably greatest to and from London and the South-east. The net movements are but a fraction of the gross and 1951 census figures of inter-regional movement show that, while the greatest number of immigrants into each region came from adjacent regions, the next greatest movement into each came from London and the South-east. Figure 14 shows something of the strength of the metropolitan pull. It is a presentation of data from the One Per Cent. Sample of the 1951 Census, which gives the numbers born in each county and enumerated in London and south-east England, *i.e.* the conurbation, plus the remainder of Surrey and Kent and Sussex. It shows the volume of gross movement to the London area and that volume as a proportion of those born in each county and still living in Britain. The greatest movement, by volume and proportion, has been from adjacent counties, but beyond this belt the decrease is not entirely in inverse ratio to the distance, for the

[1] "Internal Migration," London, Her Majesty's Stationery Office, 1951.

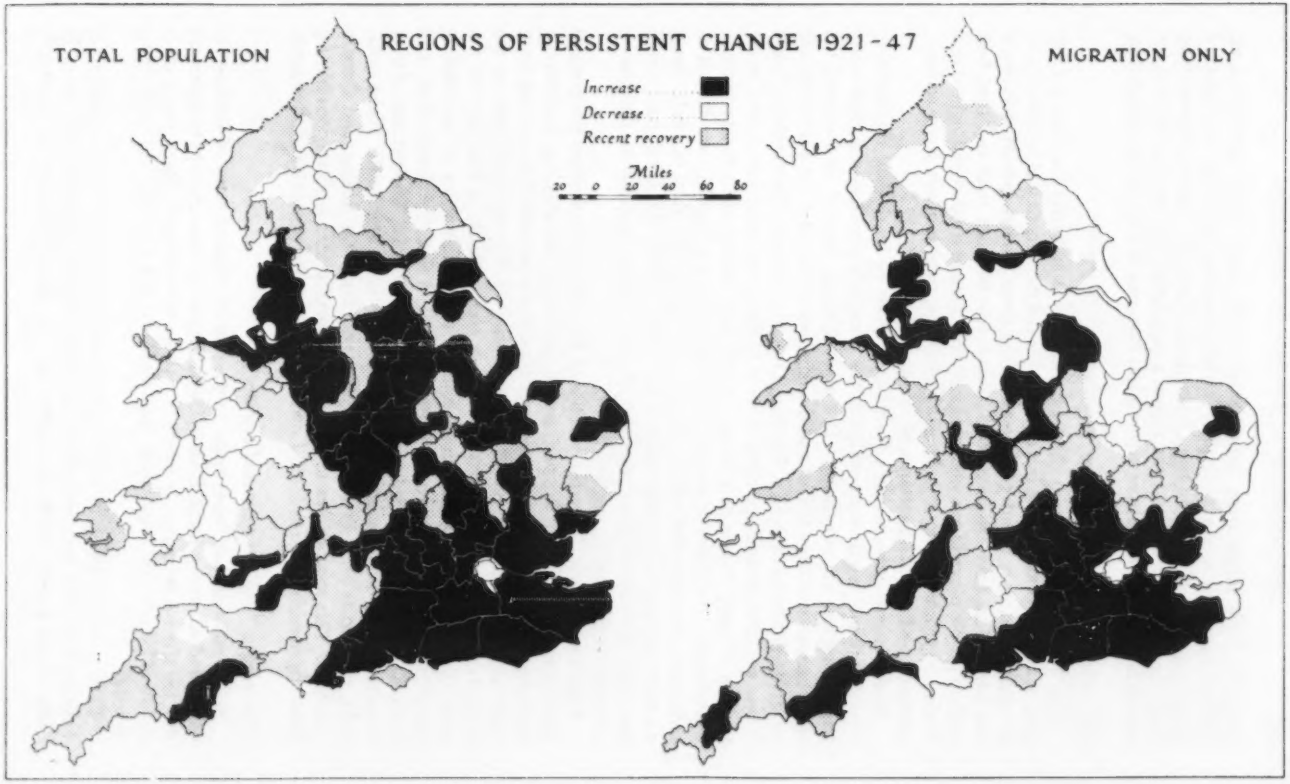


Figure 12

Figure 13

relatively high proportions from certain of the areas which have for long suffered economic recession is quite marked. London's lure has too, attracted nearly a quarter of a million from Ireland out of a total of nearly three million from the British Isles, and the region's population has been so diluted (or strengthened) that the natives are now less than one in four of the population.

The volume of population change, 1931–51

The volume of population change between 1931 and 1951 has been greater than at any previous period, but even so, the net movement which is shown is, in many areas, only about 5 per cent. of the gross movement. Miss Newton and Mr. Jeffery have estimated that in each year between 1948 and 1950 four million people moved from one local authority area to another in England and Wales, notwithstanding the housing shortage, which must have reduced mobility, and the unimportance of unemployment.

In the twenty-year period covered by Figure 15 more than three-and-a-quarter million people were added to the country's population so that many large gains are not surprising. The greatest gains were in and around the conurbations and large towns, and the increases in the adjacent rural areas are particularly noteworthy—*e.g.* Reading, Oxford, Leicester, Nottingham, York. There are considerable increases in most of the south coast towns, and in the vicinity of many towns and centres which were losing, such as Merseyside, Manchester, Hull and Norwich. London is such a special case that it is difficult to represent the volume of such increase as took place in a belt about 10 miles wide with its inner edge about 8 miles from the City. Just inside that belt is a narrow zone of slight change—either increase or decrease—reflected in the smaller symbols.

Figure 16, which shows the volume of loss for a period when the average trend was an increase of 8·5 per cent., is inevitably less striking. It naturally includes almost all the areas previously shown as persistently decreasing from 1921–47, but, because it shows volume, places a different emphasis on the subject. Thus few Rural Districts show a great volume of loss, nor for the same obvious reason do the small country towns, but there is nevertheless significance in the pattern in parts of rural Wales, the South-west, and Suffolk, which have suffered a continuous but slow loss. The net loss of over a million from London is most striking; next come the South Wales coalfield, the textile areas of east Lancashire and the West Riding, and County Durham. The misfortunes of war are, in varying measure, responsible for losses from such towns as Hull, Lowestoft, Dover, Portsmouth and Plymouth.

The relative "pull" of town and country

Some mention has been made in passing of relative rates of increase of towns and adjoining Rural Districts, and Figure 17 is an attempt to represent this for the period 1939–47 when, it will be remembered, there was a great influx of people into rural areas, and war-time and post-war influences were at work.

Each town, or group of towns where these coalesce to form a continuous built-up area, has been considered in relation to the adjoining rural area. In cases where several towns lie within any one Rural District, or conversely

where several Rural Districts adjoin any one town, the behaviour of the majority has been mapped. In these cases also, volume of population change, and the relative size of the towns has sometimes been taken into consideration. Like all other maps in this paper, it is subject to the limitations imposed by county districts.

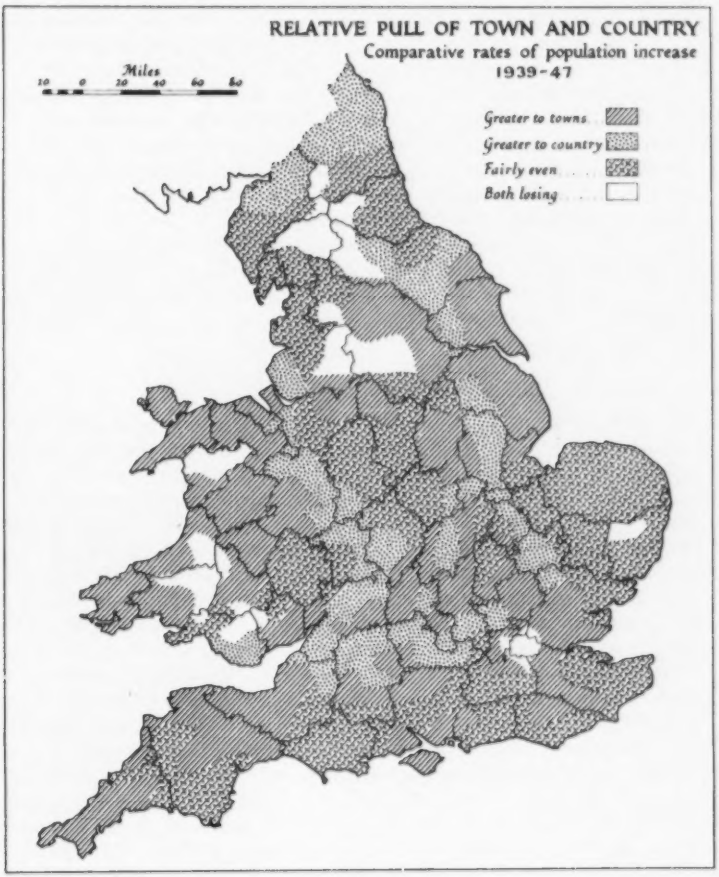
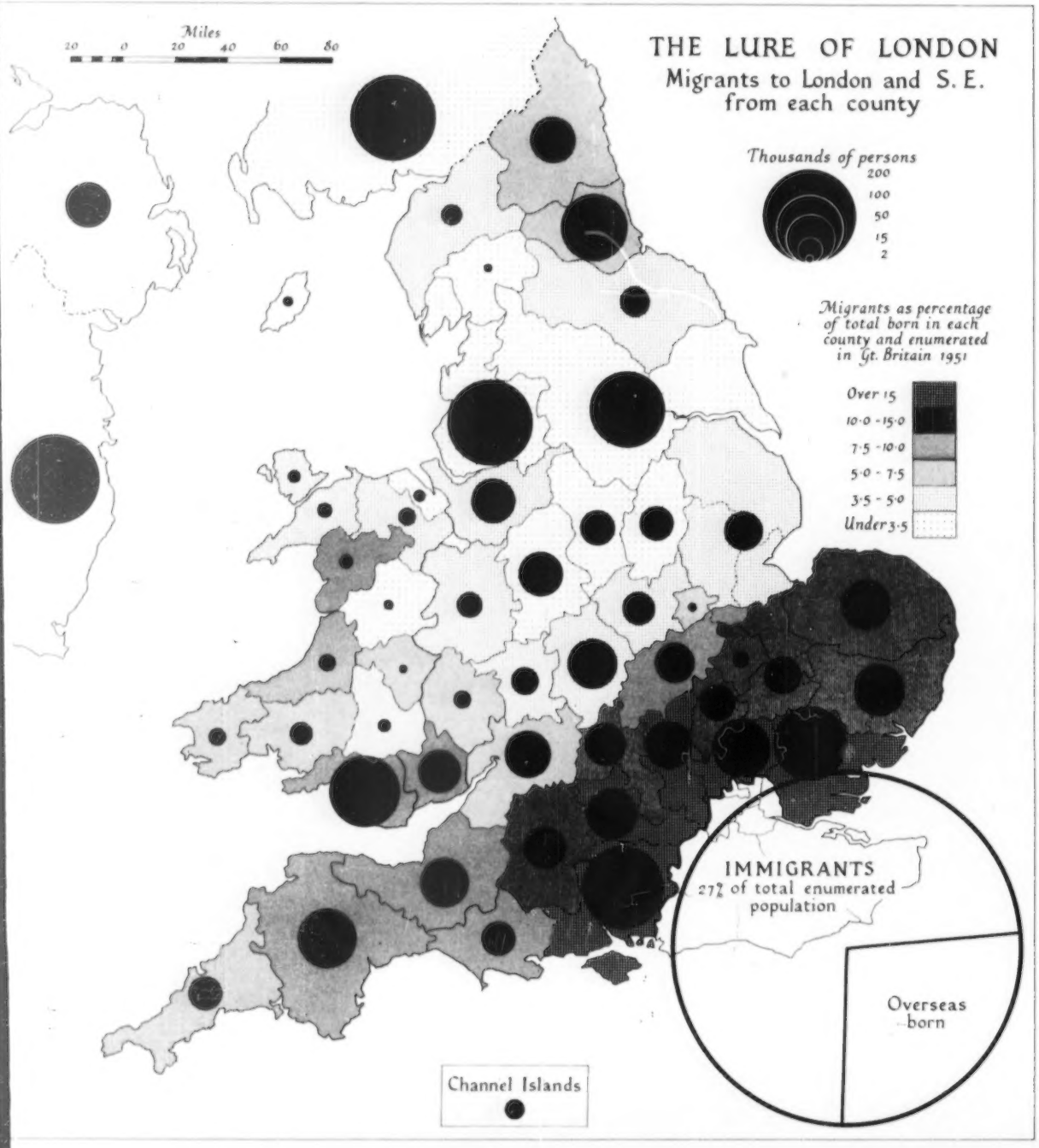


Figure 17

In the stippled areas, the towns have increased at a higher rate than the surrounding country which in some cases (notably the rural "hard cores") is declining. This "pull" to towns is especially true where towns are predominantly small, and is most common in the more rural tracts of Britain, and in areas of comparatively recent industrial development. It arises from a combination of the effects of rural depopulation and of the incoming of new


Miles
20 0 20 40 60 80
THE LURE OF LONDON
Migrants to London and S. E. from each county
Thousands of persons
200
100
50
15
2
Migrants as percentage of total born in each county and enumerated in Gt. Britain 1951
Over 15
10·0 - 15·0
7·5 - 10·0
5·0 - 7·5
3·5 - 5·0
Under 3·5
IMMIGRANTS
27% of total enumerated population
Overseas born
Channel Islands

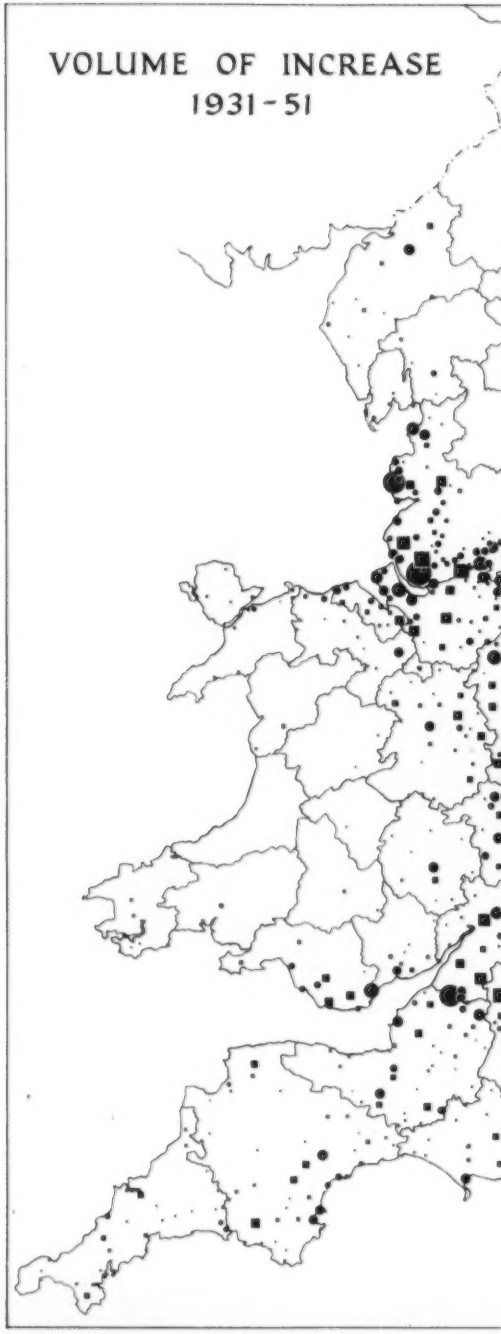

VOLUME OF INCREASE
1931 - 51

Fig. 14

Fig. 15

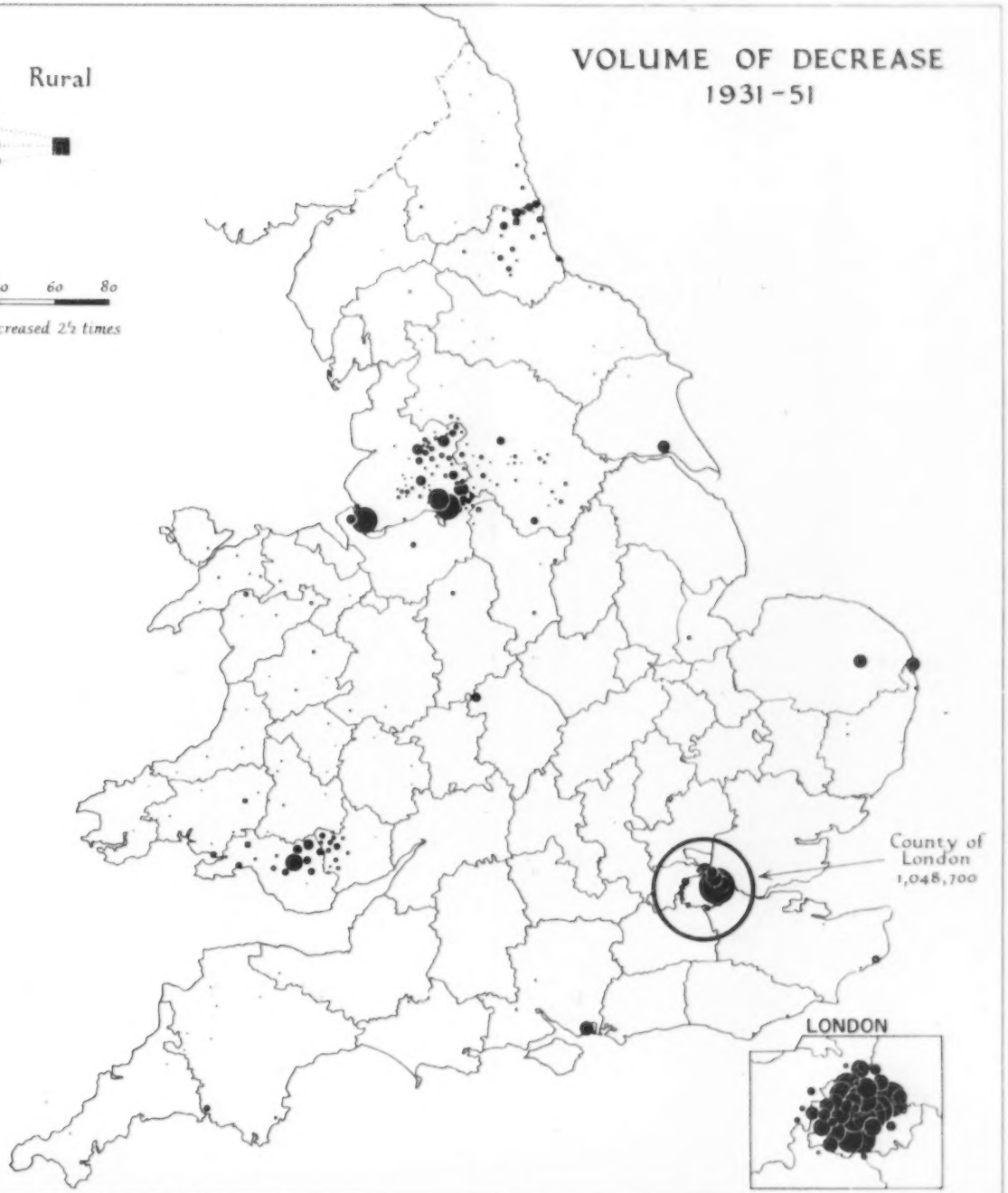


Fig. 16

WILLATTS & NEWSON

industries, which in the first instance are attracted to the towns. The former factor operates chiefly in Wales and south-west England; the latter in the east Midlands.

In the ruled areas the towns have increased at a lower rate than the surrounding country. This is normally the direct result of industrial and urban "overspill" into the country and is therefore common in proximity to urban-industrial concentrations and along their principal road and rail connections. In other cases it may arise from the revival or extension of some rural occupations such as mineral working or forestry, as in Northumberland.

The areas stippled and ruled are those where population increase is fairly evenly shared between town and country. This is likewise found near to large urban concentrations, but also takes place in areas where small towns as well as the countryside still have a high capacity for new development. In this category comes much of the residential and dormitory development, where country and small town are equally preferred.

The blank areas, except for London which is a special case, are those where population loss is most serious, for not only the country but also the towns are affected. Here there are probably forces at work which call for particular analysis by those concerned with planning the social and economic future of the terrain.

Some causes and results of population change

The two main factors which have considerably influenced population change are opportunity for employment and density of population. It has been shown that for many years population has been attracted away from the static and declining industries of the North towards the expanding industries of south and mid-England where employment opportunity is greater and more varied. On the other hand local changes have often been the result of reaction from crowded living conditions in central urban areas and the conversion of such areas to non-residential uses. The suburban fringes of towns where houses are newer and less densely packed have, since the days of motor transport, attracted people away from the more congested inner areas.

Urban losses have been heaviest on certain of the coalfields where are concentrated many of those industries which suffered depression after the First World War—*i.e.* textiles, shipbuilding, coalmining. The slowing down or even contraction of development in these older industries combined with a high local rate of natural population increase tended to create unemployment resulting in migration to expanding newer centres elsewhere, chiefly in the Midlands and South. There has likewise been a migration from exhausted pits towards the newer mines on the concealed parts of the coalfields.

Rural losses in inter-war years were aggravated by low prices for many farm products, largely the result of foreign food imports, and the demand for cheap food as a basis of low-priced manufactured goods. This led to the development of types of farming which required less labour, and in those years too, an agricultural wage which compared unfavourably with that in manufacturing industry. Many former rural industries and formerly rural services have become concentrated in nearby towns especially where the inaccessibility and poor amenities of remote areas have been most acutely felt.

A persistent decline, especially from thinly-populated rural areas sooner or later becomes accelerated because a shrunken primary population requires a smaller secondary, or service population and this tends to move to local towns. In certain village communities of the Lincolnshire Wolds, for example, the secondary element has tended to leave—first the blacksmith, the corn merchant and the brewer, then the shopkeeper, the doctor and the publican and often even the policeman, schoolmaster, rector and postmistress, so that only a small farming community remains. Shortage of labour as a result of losses from within the agricultural population itself has tended to encourage mechanization of farming but it remains to be seen whether heavier losses may result finally in less intensive farming, a change to pastoral activities, and the disappearance of some villages. Moreover, migration from rural areas has largely been from among the younger people leaving behind an ageing population. While there has been a general net increase in the number of agricultural workers since 1938, a gradual fall from the peak in 1947 suggests that further rural losses are to be expected. These may result from such diverse factors as the shortage of manpower and to the pull of higher paid industrial employment in towns, and from the adversely changing balance between older and younger people resulting from the falling reproduction rate and the migration of the young rather than the old from the land. In areas where farming is already very intensive, as in the Fens, significant increases in agricultural employment are unlikely, and here expansion of industry, largely dependent on farm produce for its raw material and on agricultural workers for off-seasonal labour, is also bound up with the future expansion of agriculture. In the future as in the past such areas may fail to provide sufficient employment to absorb their own natural increase.

The problem of rural losses becomes most acute when it results either in a shortage of labour for agriculture (as in north-west Norfolk), especially at a time of renewed intensity of home agricultural output, or where a shrunken rural population renders impossible or uneconomic the provision of adequate services and amenities as well as the less tangible social facilities which most communities desire. The tendency towards dormitory development in the most accessible rural areas has increased the possibility of providing such services there; socially rural population loss is therefore most serious in the remote "hard cores."

Population recovery since 1939 has been largely influenced by the effects of war-time conditions and their post-war extension. The intensification of agriculture, encouraged by assured markets and prices and by improved conditions of employment for the agricultural worker contributed towards a general increase in the agricultural population of most areas between 1938 and 1951. Increased employment opportunity in rural areas has come directly or indirectly with, for example, the establishments for armed forces, the influx into some rural areas of constructional workers engaged on large projects such as reservoirs, and of forestry workers. In some of these cases the population recovery which has followed may prove to be temporary.

The planned dispersal of some industry has been a further cause of recovery. There have also been improved utility and social services in some country areas.

In some areas the population has been increased by the permanent retention of war-time migrants, private individuals, schools and institutions, factories and offices. In other cases, however, the delayed return of migrants has caused a drop in population in the reception areas during the later period, 1947–51, and a corresponding rise in such former evacuation areas as the east coast and London. The housing shortage has probably deferred the intended return of others and has retarded the movement of workers whose place of employment has changed.

The exceptionally high birth rate towards the end of the 1939–47 period has also contributed towards recovery in many areas. However, a few years hence, a lack of employment opportunity in some districts, as in the past, may cause a further significant migration, especially from the more remote rural areas, of the young people who represent this increase. The subsequent falling off of the birth-rate has been sufficient in some areas (*e.g.* parts of East Anglia) to effect a natural (as distinct from total) decrease.

Conclusion

Such movements of population as we have been witnessing bring in their train vast problems; to cite but two examples, in expanding areas, the provision of new capital equipment, and, in contracting areas, of maintaining social capital resources from the revenues produced by fewer ratepayers. But these and many other matters are beyond the scope of this paper, which has only attempted a summary presentation of basic facts which seem essential to the understanding of some national and regional problems. Those facts, like the problems with which they are concerned, need detailed and continuous study. The comprehensive census data now being made available will greatly facilitate such study which, by enriching our knowledge of many aspects of population, should help to the solution of many problems of interest to the geographer, the sociologist, economist, agriculturalist and industrialist.

DISCUSSION

Afternoon Meeting, 16 February 1952

Before the paper the PRESIDENT (Mr. J. M. WORDIE) said: We welcome here, not for the first time, Dr. Willatts of the Ministry of Housing and Local Government and his colleague, Mrs. Newson. They will speak about a particular problem on which they have been working for some time, that of changes in population in the last two inter-censal periods.

Dr. Willatts then read the paper

Mr. BEAUFOY (President, Town Planning Institute): It is certainly a great pleasure to me to support my colleagues, Dr. Willatts and Mrs. Newson. Before the war physical planners got on as well as they could on estimates which were often lacking in scientific basis. In planning we are concerned with the proper use of land by and for the people. Therefore, there is great need for the geographer and the demographer, and of course for the cartographer and the statistician. Fortunately, during the war we recognized that at the Ministry and we were fortunate in getting the help of Dr. Willatts. He has built up, as you know, a very valuable cartographic section, and a large number of 10-mile-to-the-inch maps have been published. Population figures are absolutely vital.

We have had a great deal of help from the Registrar-General and now, after a long wait, we have the Census. You have heard all about the problems arising from the drift to the towns, and how we have 80 per cent. of our population living in urban areas; but the Government have accepted, in principle, the decentralization proposals of the Barlow Report. Much has already been done in the way of improving conditions in rural areas, but the problem, it seems to me, must always stem back to the distribution of employment. Are we to move people or are we to move work, or both? There are many workers tied by agriculture; others tied by minerals; those connected with the sea, fishermen and dock workers, are tied. There are manufacturing interests tied to raw materials, by the climate and, to a lesser degree, by markets. But even then there is a large residual of industry which can equally operate in one place as in another. Naturally, industrialists wish to settle where there is a large pool of labour and it is natural that labour should want to be where there are many opportunities of varied employment. So that you will realize with what tremendous problems planners are faced. We have made a start; we have started in this country and in Scotland fourteen new towns; but we must not expect too much of them because even when those towns are fully developed the resultant decentralization of industry though gratifying is not great.

Recently there has been the Town Development Act, which is dealing with the development of smaller towns. There again, that must be an absolute failure unless we can at the same time move the population out to these towns and take the industries with them.

From all I have said you can see how vital it is that we should keep constantly our eyes on the course of events, to measure and analyse trends and movements of population and to assess our progress.

Dr. Willatts and Mrs. Newson have shown very clearly how important that is and what has been done. I move a very hearty vote of thanks for the paper.

Dr. DUDLEY STAMP: I am sure you would wish me to congratulate Dr. Willatts and Mrs. Newson on this remarkable example of a sound piece of factual work It is tremendously important that one should analyse with the care which has been shown this evening the facts which we actually have, and to separate them from the second stage—the attempt at interpretation, where we may find ourselves differing from our colleagues.

Towards the end of the paper the authors indulged in an attempt to interpret the facts given. Now that is the stage when colleagues at the Ministry begin to get interested. One of the things which we find in investigations of this nature is that instead of the answers being clear, they uncover a further number of problems and a need for continuing research.

Let us think of some of the difficulties which the authors have faced and perhaps glossed over, tied by the use of the administrative areas which seem often deliberately chosen so as to fox the geographer as much as possible, and certainly to fox the administrator. For instance, I think I am right in saying that all those people who daily hit rivets, or whatever it may be, in the neighbourhood of Didcot are all rural because they live in a rural district.

There is that first difficulty, and that is why I know the authors would like me to pay tribute to one of their own colleagues, Mr. Stanley Vince of the same Ministry, who wrote a paper in an attempt to break down the rural population into the different types of workers and into the third group which the Government have called the "adventitious population," those who live in the country because they wish to do so.

Behind the figures and the maps which Dr. Willatts has shown us there are two or three things still hidden; for example, what is the importance in the life

of the country of that very large number, one-eighth of the total population at a guess, who are retired or over age, unemployed in that sense? It is true that industrial location is the keynote for the provision of work to the younger and those of middle age, but I sometimes wonder whether the offer of inducements for those who are retired on pension would not give us the opportunity of redressing the balance in a desirable way.

We have had this evening a national standard of what is happening from the national point of view. It is a yardstick by which anyone in local government can gauge what is happening in his own area and thereby gain a useful guide to relationship to local development in the national pattern. I am sure that the Society is fortunate in having had such a scholarly presentation of such an immense amount of material.

I wonder if it is too early to draw conclusions? For 1947 I am sure it is. As to 1951 how many firms are still evacuated because their former premises in the City of London are still non-existent? How far are we yet back to the post-war trend for that reason alone? So that it is work, I am sure, which must be continued and carried on to each stage as information becomes available.

Miss M. P. NEWTON: As one who has come from the Registrar-General's Department, I feel I am speaking for a number of us when I say how refreshing it is to see the material, whose dry bones we fashion, put into its geographical setting, as Dr. Willatts and Mrs. Newson have done.

I hope Dr. Willatts will forgive me if I make one or two comments, not on the information and the conclusions which have been drawn, but on the techniques of mapping that have been so ably developed over the last ten years. We have become familiar with the maps of local population change which cover three distinct periods from 1921, each showing by circles and squares of varying sizes the volume of population change, and by depth of shading the percentage change, experienced in each locality. We have also seen this afternoon some of the more recently developed mapping techniques, in particular an attempt to summarize the experience of the three main periods on one map. I find myself needing to refer back to the more detailed presentations to get the sense of these summary maps, and wondering whether perhaps the simplifications that have perforce been introduced are a little misleading. Figures 2 and 10 for instance, which merely show in which periods there were population gains and in which there were losses, without taking account of the magnitude of these changes, may suggest, to the unwary, population pouring out of rural Wales, whereas Figure 9 shows that the actual volume of this movement was very small.

I am only saying this to make a plea, if it is necessary, that in the development of the map technique as shown in more recent maps we do not lose the continuity of the older type of presentation, and that the older technique should be retained and applied to new periods as time goes on.

Another aspect of the changes that have been described concerns the very difficult question of urban-rural changes. I feel that a presentation in terms of data for local authority areas and covering a period ending so soon after the war as 1947, should be used very cautiously. Dr. Willatts has referred to the difficulties of interpretation of data which are tied to administrative area boundaries. I should like to ask him what possibilities there are, using data from the surveys for Development Plans or otherwise, of constructing a map of built-up areas, and how much real difficulty there would be in defining built-up areas for such a purpose? If we had such a map and could see in terms of the smaller administrative areas of wards and parishes which ones were largely built-up, does Dr. Willatts think this would provide an adequate basis for a study of the distribution of population as between urban and rural areas which

could be made when the 1951 Census figures for these small areas become available?

Dr. G. P. WIBBERLEY: Though working almost entirely on the rural side of land use I would like to add my thanks for the very valuable background information which Dr. Willatts and Mrs. Newson have now provided. It is information on population which we can link with other information we have in relation to the agricultural expansion programme. But if we take the information that the authors have prepared and start applying it to some of the thinly-populated areas of poor land we must be careful. There is a danger in such analyses, in that we automatically believe that there is something radically wrong with an area that has constantly lost population, but that if it is constantly gaining, things are very much better. If we take the hard-core areas in central Wales and ask what we can do, in particular for the agricultural structure, to help them, we find that we have still too many people in those areas. We can argue that we could do very much better, particularly from the economic point of view, with fewer and larger farms in those areas and with fewer and more concentrated services, and possibly services of a lower standard. When we look at the eastern side of the country, at the Lincolnshire Wolds, we find a farming structure which is made up of large farms, well laid out. Even though areas may have a sparse population and a thinning agricultural community, personal incomes, standards of living and farm output have all increased in recent years. Using these yardsticks, it is difficult to say at what point those in agriculture will suffer because though they have good farmhouses, good cottages and good jobs to offer, there are very few people in the district because the population pattern has crumbled outside the farms. We must be careful not to think that in these "hard-core" areas all the problems are concerned with thinness of population.

Dr. WILLATTS: Mrs. Newson and I appreciate the remarks made in regard to mapping and analysis in research. And of course we agree with the sentiments expressed by Mr. Beaufoy and Professor Stamp that there is need for continuous study of problems which at first sight frequently appear simple but which on further analysis reveal themselves to be immensely complicated. It is always difficult, when asked to investigate a problem, to meet the needs of those who want a simple answer to a problem which at first does not appear nearly so complicated as one discovers it to be when doing further work on it.

There is a great deal still to be done and I think that is the answer to Dr. Wibberley's question. It is not necessarily true that it is a bad thing if an area is consistently losing population, but it is evident that it then wants watching carefully, and it may be that some positive action could help the people who remain in such an area to enjoy a full social life. It may be that some positive encouragement given to what Professor Stamp has referred to as "the adventitious population" to go into those areas might be the answer. Only further study can show that.

Miss Newton expressed appreciation of the full-scale 10-mile-to-the-inch maps that have embodied a great deal of information and have been designed to balance the erroneous idea one tends to get by looking at only increase or decrease by trend, by introducing the element of volume at the same time. We had to run the risk of not doing that with the maps shown on the screen this afternoon because the screen demands as far as possible simple black-and-white maps, and one cannot then balance up the factors. All one can do is to resort to one map after another, one dealing with one aspect and one with another, and trust that an intelligent audience will not be misled by one or the other.

Miss Newton asked a specific question as to whether a detailed map of

built-up areas could be produced and used in studying the 1951 Census information. Offhand, I would not like to answer with a positive Yes or No. It is certainly desirable. In the terms in which Miss Newton cast the question: could it be done from the plans and maps submitted by local planning authorities to Whitehall as part of their development plans, dated 1951—the answer must regretfully be "No," because if a map of uniform quality is desired it is necessary to take as the standard the lowest quality data available, and it is not, of course, of uniformly even quality. But I am not saying that something could not be done from various sources, and no doubt if sufficient resources were devoted to it a map could be prepared of built-up areas.

I do not think there is any cause to reply to the other points made by speakers except to reiterate that there is much yet to be done. All we really have attempted to do this afternoon is to provoke further thought as a result of presentation of basic data.

The PRESIDENT: I offer my personal thanks to Dr. Willatts and Mrs. Newson for what they have told us this afternoon and also to the various speakers who have contributed to the discussion.

'THE MARINERS MIRROUR' 1588

G. R. CRONE

AS THE PRESIDENT announced at the Annual Dinner in June, Dr. A. Hamilton Rice, a Gold Medallist of the Society, has presented it with a rare volume of early charts to commemorate the Coronation of H.M. Queen Elizabeth. The volume is 'The Mariners Mirrour,' translated from the Dutch by Anthony Ashley, and published in London in the year of the Spanish Armada, 1588. The 'Mirrour' was the first set of charts engraved in England, and this generous gift is an important addition to the Society's collection of early charts and navigating manuals.

The Dutch original, a copy of which is also in the Society's collection, is entitled 'Spieghel der Zeevaert.' It was compiled by Lucas Janszoon Wagenaer of Enkhuizen, and published by Christophe Plantin at Leiden in two parts, in 1584 and 1585. It consists in all of forty-five charts or "sea cardes," covering the western European coasts from the Baltic to Cadiz, engraved by Jan van Doetecom; brief sailing directions, printed on the backs of the charts; an introduction on the purpose and use of the charts, and material useful to the navigator, including lunar, declination, and tide tables, and methods of determining latitude by stellar observations.

Wagenaer was the first to bring together written sailing directions and marine charts, systematically arranged, into one uniform volume.[1] His work was consequently warmly welcomed, and went into many editions; by the end of 1585, four editions of the first part, three editions of the second, and the first combined edition in Dutch had appeared. The following year a Latin version of the complete work was published, and French and German translations followed.

In the Latin edition of 1586, the first part of which was dedicated to Queen Elizabeth, Wagenaer relates that a copy of his work was brought by the Lord High Admiral, Lord Howard of Effingham, to the attention of Queen Elizabeth's Council in 1585. The Council esteemed it "worthy to be translated and Printed into a language familier to all Nations," and thus encouraged, Wagenaer produced his Latin edition of 1586.

From the introduction to the 'Mirrour,' it seems that the Latin edition was not considered to meet the needs of the English navigators, for Anthony Ashley records in his preface that in 1587 at the "commandment and charge" of Sir Christopher Hatton, he undertook the task of translating the 'Spieghel' into English.

The English edition, in folio, like the Dutch, appeared in 1588 with the title:

"The Mariners Mirrour Wherin may playnly be seen the courses, heights, distances, depths, soundings, flouds and ebs, risings of lands, rocks, sands and

[1] On Wagenaer and his work, see Gernez, D.: "Lucas Janszoon Wagenaer; a chapter in the history of guide books for seamen," *Mariner's Mirror* 23 (1937) 190–7 and "The works of L. J. Wagenaer," *ibid.* 23 (1937) 332–50.

shoalds, with the marks for th'entrings of the Harbouroughs, Havens and Ports of the greatest part of Europe; their several traficks and commodities: Together wth. the Rules and instruments of Navigation.

First made and set fourth in divers exact Sea Charts, by that famous Navigator Luke Wagenar of Enchuisen And now fitted with necessarie additions for the use of Englishmen by Anthony Ashley.

Herein also may be understood the exploits lately atchived by the right Honourable the L. Admiral of England with her Ma^ties. Navie; and some former services don by that worthy Knight Sr. Fras. Drake."

The title-plate, engraved by T. de Bry, in general design follows that of the 'Spieghel,' with its display of nautical instruments: quadrant, astrolabe, cross-staff, sand glass, lead line, compasses, and mariner's compass. The Royal arms, however, have been added, and the costumes of the two supporting figures are different.

The title-plate is not dated, but Ashley's dedication has the date 20 October 1588. Dr. A. M. Hind, however, considers that it did not appear until 1590, holding that "the reference on the title-plate to the understanding of the "exploits lately atchived by the Lord High Admiral" seems to refer to Ryther's *Armada Plates*, so that the work can hardly have appeared before the same year 1590." To this he adds the footnote: "Though there is nothing in the text in description of the *Armada Plates*, the relation being 'understood,' and perhaps taken for granted." He also refers to the delays mentioned in the dedication.[1] It would seem more probable that the "exploits" refer to the defeat of the Spanish Armada in the year given in the dedication, *e.g.* 1588. Ryther engraved three plates only, all dated 1587, so that his share was quite small, and it is difficult to see why the 'Mirrour' should have been further delayed to await the publication of his Armada plates. There seems little reason therefore to reject the date of publication, 1588, generally assigned to it.

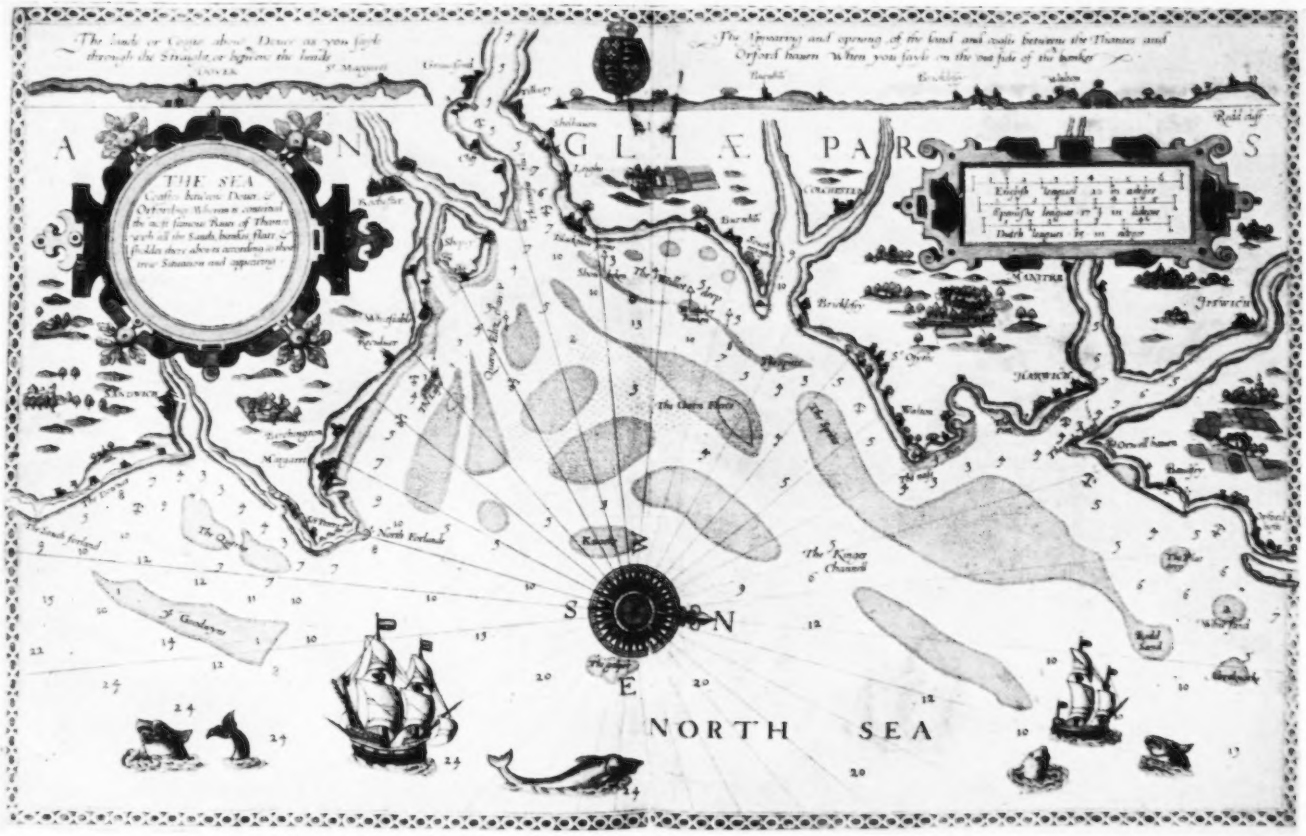
Seventeen of the charts are signed by their engravers; ten by T. de Bry, three by Jodocus Hondius, three by Augustine Ryther, and one by Jan Rutlinger. All these engravers were at that time working in London. Ryther had engraved plates for Christopher Saxton's county atlas, and was also the engraver of the Armada plates to accompany the 'Discourse concerninge the Spanish fleete,' 1590. It is perhaps significant that all three of his plates in the 'Mirrour' are dated 1587; only three other plates are dated, all 1588, and it may be that Ryther ceased work on the 'Mirrour' for other tasks, *e.g.* the bird's eye plan of Oxford which he produced in 1588. Perhaps it was interruptions such as this which prompted Ashley to complain in his introduction of "negligent gravers."

The plates in the 'Mirrour' are close copies of those in the 'Spieghel.' This correspondence extends even to the details of the often involved and elaborate ornamentation. In the main, also, the outline and details of the charts are followed exactly. Here and there, however, on the charts of the British coasts, some alterations have been made. English forms of place names have been substituted for the Dutch renderings of the originals. On the Isle of

[1] Hind, A. M.: 'Engraving in England in the sixteenth and seventeenth centuries. I. The Tudor Period.' Cambridge, 1952, p. 26.

William Hutton
Hutton Park
1785
THE MARINERS MIRROVR
Wherin may playnly be seen the courses, heights, distances, depths, soundings, flouds and ebs, risings of
lands, rocks, sands and shoalds, with the marks for thentrings of the Harbourroughs, Havens and Ports of the
greatest part of Europe: their seuerall traffickes and
commodities. Together wth the Rules and instruments
of Navigation.
AVTHONY ASHLEY.
S.r FRA. DRAKE.

Title plate, half the scale of the original



'The Sea Coastes betweene Douer, & Orfordnes: Wherein is conteined the most famous Riuer of Thames . . .' Two-fifths the scale of the original

Wight–Dover chart, "Beuechier" become "The Beache" (Beachey Head), "Brightem" Brighthelmston, and "Chilchester," apparently a confusion of Chichester with Selsey, is replaced by Chelsey, and "Lemton" is rendered Lemington. A few names are also added, *e.g.* Calshot and Studland Bay. The positions of some towns are also altered for the better; Brighton and Shoreham are removed from the lower Ouse to the coast, and Lymington is more accurately placed. Most alteration has been done on the chart of the Thames estuary. Rochester is placed on the correct bank of the Medway, and a bridge inserted to link it with the original town symbol. Birchington has been inserted also, but the Nore and Deal, shown by Wagenaer, are omitted. Several changes have also been made to the position of sand banks and channels in the estuary, and though still rather crude, the chart gives a generalized view of the channels and swatches. "Queene Eliz. chan." (now Queen's Channel) is shown and named. This channel was then beginning to be used as an alternative to the South Channel, along the North Kentish shore. Also shown is the "Kinges Channell," the approach to the Thames from the north-east by the Swin. Two important marks are also inserted: "Show beken" (Shoe beacon) and "Whittaker beaken." Though an improvement on Wagenaer, the chart is however inferior to the contemporary work of Robert Norman and William Borough.[1]

An examination of the charts of the English Channel coast shows that in effect they are made up of fairly detailed charts of the principal harbours, and that the intervening coast line is represented very summarily. This tendency is reflected also in the accompanying text, which consists essentially of directions for approaching them. The result is to give an unrealistic outline of the coast as a whole. Along the coastlines have been added profiles indicating the appearance of the land from the sea, and naming conspicuous sailing marks. Vacant spaces on the charts are occupied by similar vertical profiles, derived from those in the written sailing directions.

The purpose of the charts, as originally stated by Wagenaer, was threefold: to help the pilot to recognize his landfall from the "the severall arisings and appearing of every country"; to give the compass direction of the desired haven, and the banks, rocks, etc., to be avoided; and to show the shore marks to be brought into line in entering.

As regards the text, the differences between the English version and the original are not considerable. Ashley claims that he has "(be it spoken without prejudice to the Aucthour) by the advise of the best experienced, . . . in many places amended and bettered him; Besides the fit application of the Tables to the English stile and Calculation, explained with divers familier examples." The reference to the "English stile and Calculation" indicates that in his examples he follows the old style calendar and the meridian of London, where Wagenaer had used the Gregorian calendar and the meridian of Enkhuizen.

A second edition of the 'Mirrour' was published in 1605. This appears to have been generally overlooked, and I am indebted to Mr. Johannes Keuning

[1] Outlines of Norman's chart of 1580 and Borough's chart of 1588 are given in Robinson, A. H. W., "Changing navigation routes of the Thames estuary," (*J. Institute of Navigation* 4 (1951) 357–70.

for drawing my attention to it.[1] The only copy so far traced is in the Universitetsbibliotek, Lund, and Dr. Herman Richter, the Librarian, has kindly supplied the following particulars. The title is identical as far as, and including, "And now fitted with necessarie additions for the use of Englishmen." This is followed by "Jodocus Hondius excudit ann. 1605." Small additions have been made to the plates, mainly brief legends in Dutch. On the chart of the Thames estuary, a second compass rose, with direction lines, has been inserted in the lower left-hand corner. The accompanying explanatory text is in Dutch. It would appear, therefore, that Hondius acquired the plates used for the edition of 1588 and re-issued them in Amsterdam. Dr. Richter has kindly offered facilities for further examination of the volume, and I hope to give more details later.

For a century at least after the publication of the 'Mariners Mirrour,' the Dutch continued to be the principal suppliers of engraved charts for the English market. John Seller's 'Coasting pilot,' 1672, was largely printed from plates obtained from the Netherlands.[2] It contains, however, an original chart by Gilbert Crane, Thomas Browne and Jonas Moore: "Draught of the sands . . . upon the coast of England, from the South-foreland to Orford Ness." The features of the estuary on this are quite close to those depicted by Robert Norman in 1580—evidence of the considerable time lag before the practical knowledge of the pilots was put into general circulation. The appointment in 1681 of Captain Greenvile Collins to chart the coast of Great Britain was the first step towards the establishment of a national hydrographic survey.

Mr. George Naish, of the National Maritime Museum has pointed out to me an interesting passage in Samuel Pepy's "Naval Minutes" bearing on Dutch and English charts[3]; "Note that Sir Anthony Ashley's books of maps were never printed but once, nor any other by anybody else of any consideration till Seller's, and Ashley's never lookt after: whereas the Dutch Waggener has been continually kept in print and sold under many names over all the world in diverse languages, and continually preferred and used by us, notwithstanding Ashley's pretence to have corrected him."

"Nay, so much is the reputation of the Dutch better than ours for seamaps, and even among ourselves too, that the Dutch have thought it worth their while, even at this very time, to copy out Seller's own map in English, which they are too good husbands to do if they could not sell them unto us."

[1] Behrmann, W.: Über die niederdeutschen Seebücher des funtzehnten und sechzehnten Jahrhunderts, *Mitt. Geogr. Ges. Hamburg*, 21 (1906) p. 170.

[2] Crone, G. R., "Early books and charts in the Royal Geographical Society's collection." *J. Institute of Navigation* 7 (1953) 38–43.

[3] 'Samuel Pepys's Naval Minutes,' ed. by J. R. Tanner. *Navy Records Soc.*, 1926, p. 19.

THE LOWER SHIRE VALLEY OF NYASALAND: A CHANGING SYSTEM OF AFRICAN AGRICULTURE

W. B. MORGAN

THE SHIRE RIVER has often been mentioned in the pages of the *Journal*. Professor Debenham (1948) has explained the causes of its marked changes in level and Sir Alfred Sharpe (1936) and Mr. G. L. Gamlen (1935) have dealt with the question of transport upon its waters. As yet, however, no one has described the difficulties confronting the people who dwell on its banks, a people almost wholly dependent upon a distinctive pattern of cultivation shortly to be affected by a plan of conservation and river control known as the Shire Valley Project. The author visited the lower portion of the valley from its upper limit at the Murchison Falls down to its confluence with the Ziwe Ziwe distributary of the Zambesi (Fig. 1) during the dry season of 1951, when a study of African agriculture and of the effects upon it of European controls was made.

Africa is beset by problems affecting the possibilities of future economic development. The Lower Shire Valley is no exception to the general rule. Indeed, it is rather more heavily endowed than many parts of that continent with difficulties of every variety. The cardinal problem is that throughout its British portion, which amounts to some three-quarters of the total area, it is overcrowded. Population has increased partly because of the suppression of the slave trade and of other attacks upon the local Amang'anja tribesmen, and partly because of the immigration of Asena from the neighbouring portions of Portuguese East Africa, particularly after the suppression of the Bawe Province rising in 1917. The valley was attractive to peoples already used to the high temperatures characteristic of lowlands in these latitudes for, in addition to *mphala* or land dependent on rains for cultivation (November–April), it provided large areas subject to annual flooding on which crops could be raised in the dry season (May–October). The existence of such floodland for *dimba* or dry-season gardens is vital to the agricultural economy of Central Africa and has an important influence on the distribution of settlement. By 1936 a rise in the minimum level of the Shire had produced an enormous loss of seasonal floodland. The Agricultural Report claimed a decline in *dimba* acreage of 41 per cent. compared with the previous year. By 1939 it was computed that 120,000 acres of dry season arable land were now permanently under water. This flooded area consists of a series of "flats" forming the lowest terrace of the Shire—hence the sudden loss of land in spite of the fact that the river's rise had been spread over a long period of years. Seasonal floodland became restricted to the gentle slopes above the terrace and reduced further in area by a decline in the range between maximum and minimum flow. The agriculturalist was forced to use larger quantities of *mphala* and since this gives lower returns than the flooded areas, many more acres were needed than the lost 120,000. The *dimba* had been the major producer of

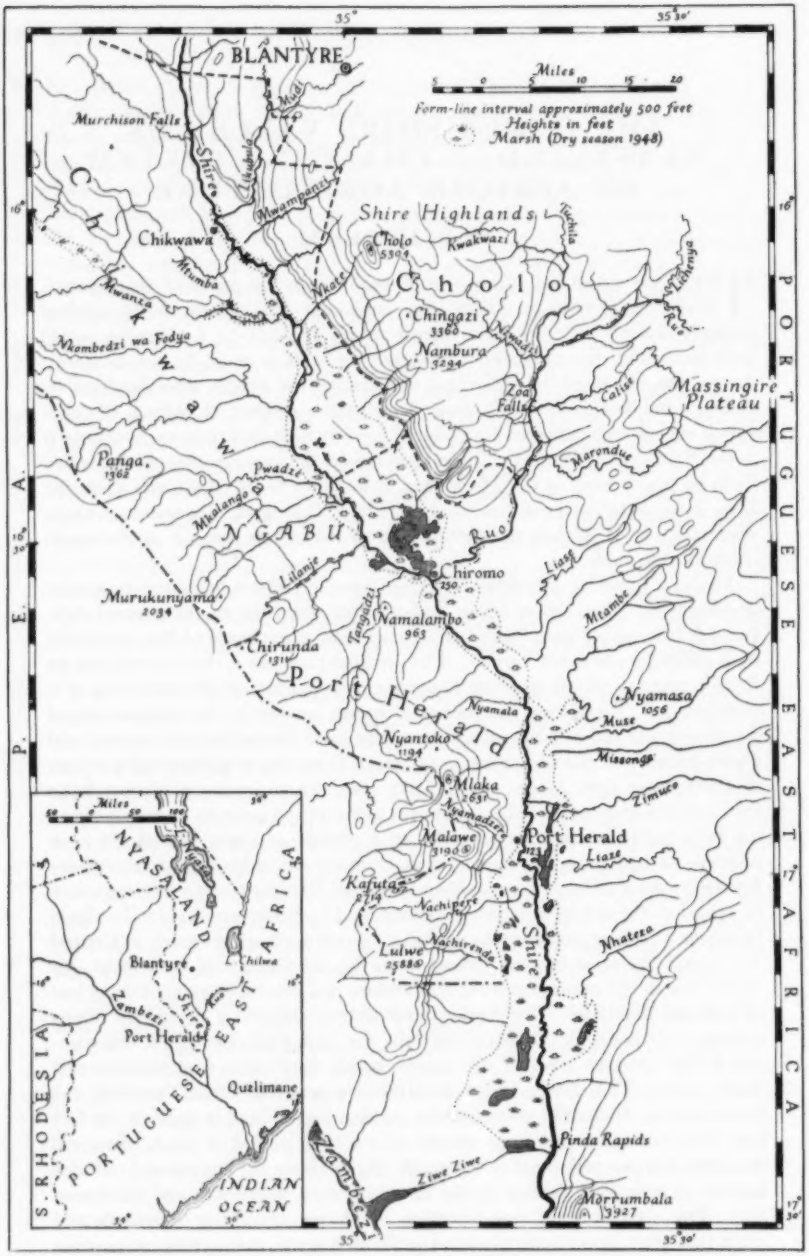


Fig 1. Lower Shire Valley

native cotton grown from seed supplied at first by the British Cotton Growing Association and later by the Government. Thus it had provided the cash needed for the purchase of cloth and metal goods and for the payment of taxes. Now the Government cotton growing policy had to be changed. The crop would have to be produced during the wet season on *mphala* land.

There was plenty of land with water enough for raising crops during the wet season. The problem facing settlement on such land was to find adequate supplies of domestic water during the dry part of the year. Accordingly in the 1930's the Geological Department undertook the construction of wells in the "central belt" of low water table between the hills and the river, particularly in the Ngabu Native Authority of Chikwawa District where dark brown loams were thought to offer excellent opportunities for cotton cultivation. Of the two districts comprising the region, the southern or Port Herald District, once the chief cotton producer, had suffered more severely from loss of floodland. Accordingly it was from this district that people were drawn to operate the new scheme. Between 1931 and 1945 the estimated total African population of Port Herald District decreased from 81,410 to 66,746 whilst that of Chikwawa District increased from 35,892 to 59,664. The results of this policy were a greater dependence on rainfall, a marked increase in bollworm infestation of cotton, and the attainment of the limit of cultivable land without resorting to irrigation or reclamation.

The total area cultivated in the two Lower River Districts in 1951 has been estimated to be approximately 242,600 acres (including hill lands, *i.e.* over 500 feet above sea-level) of which about 10 per cent. was subject to seasonal flooding (Fig. 2). This total area makes only 14·4 per cent. of the whole. The proportion is low, but that it marks the approximate limit of cultivable land may be judged by several facts. The system of agriculture employed is without manures, crop rotations and fertilizers. It is basically a system of rotational bush-fallow which avoids soil deterioration by periodic forest destruction. In Port Herald and Chikwawa Districts, however, the migration necessary for this process has almost entirely ceased. The necessary acres are not available. A little fallow under secondary vegetation cover exists in Chikwawa, but to the south hardly any fallow can be found. Comparing conditions with the neighbouring portions of Portuguese East Africa (Morrumbala Circonscription) where sufficient forest remains for the full practice of the system, a minimum of 30 acres of cultivable land would be needed per family giving a maximum density for such land of approximately 105 persons per square mile. In the Lower River Districts the density on cultivable land in use, *i.e.* cultivated land plus the small portions of fallow adjacent to the gardens, graveyards, roads, paths and village sites, is 334. Outside this area there is no evidence of any attack being made or having been made on the vegetation cover except on very steep slopes or stream banks now proscribed by law. There is therefore every indication of overcrowding with little or no agricultural migration resulting from a lack of room for expansion. The only reliefs to the progressive degradation of the *mphala* soils consist of unlooked-for cattle droppings when the beasts are allowed to graze amongst dry season stubble, and exceptionally high flooding of the Shire as in 1952 when extensive damage and loss of life occurred. The two chief types of forest cleared

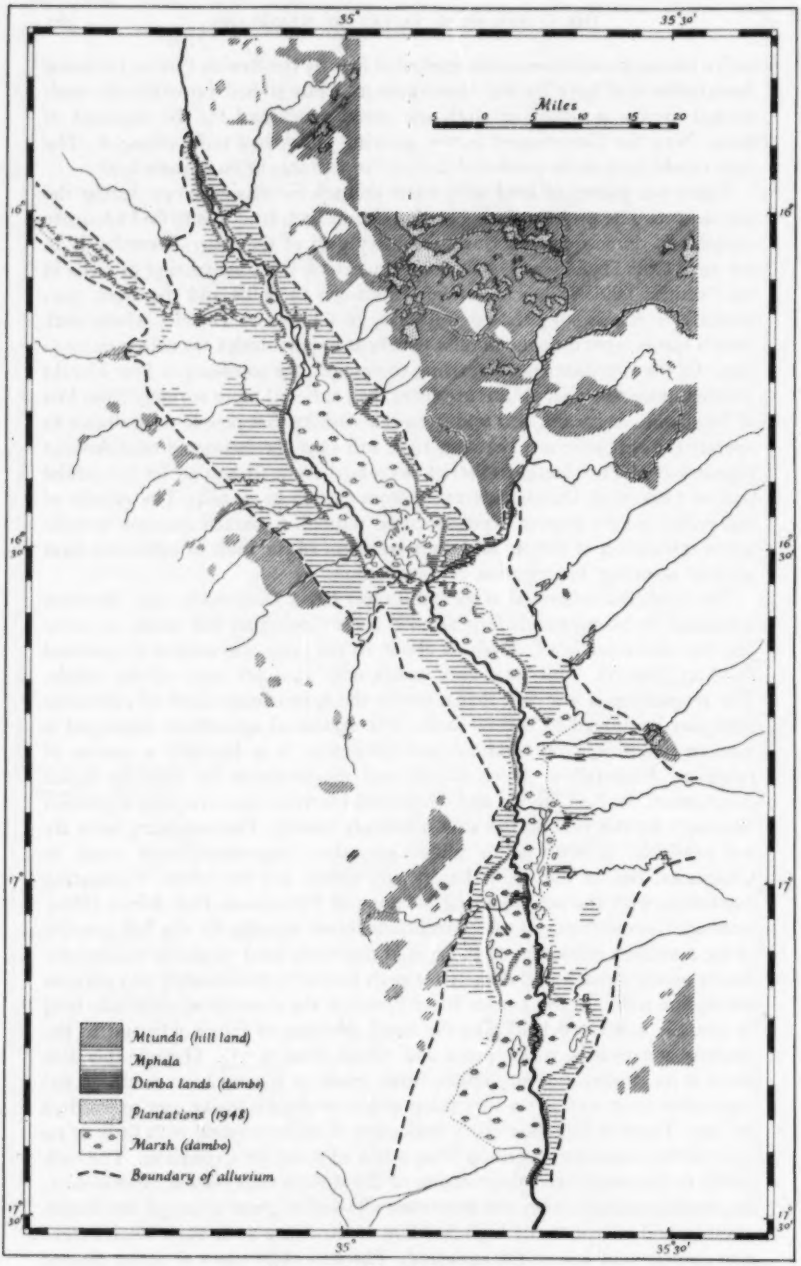


Fig. 2. Cultivable land in use

for cultivation are the acacia—sterculia—baobab association of the valley floor, and the brachystegia—uapaca—isoberlinia association of the hills. Of these forests there is very little remaining suited to agriculture and that little is usually to be found on steep slopes, or in areas of too low a dry season water-table for the satisfactory provision of wells. There are extensive stretches of brachystegia forest in the western hills and in the Mwanza basin in the north-west, but only in degenerate forms indicative of semi-arid conditions. Increased pressure on the land should result in diminution of the size of holdings, and with pressure greater in the south than in the north in spite of population decrease, one would expect a contrast in the size of holdings between the two areas. Unfortunately detailed information on the size of holdings is not available. Estimates made in the field combined with calculations of the area available per family unit suggest that in Chikwawa District holdings average about 9 acres whilst in the area to the south of Port Herald they are rarely more than 6 acres. Each year, however, the Agricultural Department of Nyasaland provides statistics of garden sizes claimed to be solely for non-flooded land and based on field-work by native assistants during the wet season. Altogether there are 375 items for the 1950/1951 season in the Lower River Districts. Each item is the average size of gardens under a particular crop for a native authority or sub-authority. As almost all gardens contain two crops there is a considerable overlap of actual garden sizes in the results. The figures have been analysed graphically by ranking them in order of size with the following results: (i) the pattern was practically a uniform curve with the greatest deviation in the upper storey, *i.e.* amongst garden groups averaging more than 2·45 acres; (ii) small but marked vertical breaks divided groups of mean garden sizes; (iii) at the lower end of the graph a "tailing-off" indicated the inclusion of some *dimba*; (iv) the degree of uniformity exhibited in the curve suggests that the size of gardens is an important factor in African agriculture.

From the graph five groups of garden sizes were determined as follows:

	Acres	*Mean*	*No. of items*	*Percentage*
1.	0·01–0·65	0·19	279	74·4
2.	0·65–1·00	0·88	25	6·7
3.	1·00–2·00	1·56	41	10·9
4.	2·00–2·50	2·33	16	4·3
5.	2·50–5·86	3·54	14	3·7
			375	100 per cent.

Analysis of the distribution of crops by the above groups confirmed field observations and revealed that group 1 is a kitchen garden concentrating chiefly on finger millet, cassava, beans and pulses, whilst group 5 is devoted entirely to mixed maize and cotton as cash crops. The three intermediate groups all serve the same function of chief food garden—occasionally with a cash supplement—being planted with bulrush millet, sorghum, maize and cotton in various combinations. It was concluded that the three-fold division of what is essentially a single type of garden resulted from areal differentiation

with the process of declining size due to overcrowding, following the holding pattern. It was discovered that for growing the four crops concerned the southernmost authorities, *i.e.* those south of the Nyamala, concentrated on groups 2 and 3, the central authorities between the Nyamala and Ngabu had little else but group 3, whilst the northern districts excluding Ngabu grew maize and cotton in groups 3 and 4, but left their millets to group 1. Calculation of approximate mean garden sizes by native authorities (only "approximate" since the sizes overlap) confirmed this distribution giving the smallest figures—about 0·75 acres—for the five southernmost authorities, and all arranged in descending order from north to south. Thus on analysis the results follow so closely the expected behaviour of holding sizes that it is suggested that increase in population pressure first produces the reduction of fallow, and then follows that by reducing the sizes of gardens. The large cash cropping group 5 is a feature of European planning confined with only few exceptions to Ngabu Native Authority.

Examination of the distribution of maize and millets provided evidence of the degradation of soils with lack of fallow, for as humus content was lowered and soils became lighter it became necessary to plant a hardier crop giving poorer returns in order to ensure any return at all. Thus finger millet was found to be gaining ground at the expense of bulrush millet, bulrush millet at the expense of sorghum and both bulrush millet and sorghum at the expense of maize. It was admitted by local agricultural officers that much of the land was kept under maize only because of the conservatism of the growers, and would be better planted to millets. Soil erosion by sheet wash and gullying is a natural result particularly in the area of lightest soils—the sandy low-water table central belt between the river and the hills. Attempts have been made to counter the effects of sheet-wash by ridging, but little attempt has been made to control the gullies which are particularly well developed along paths and roads on the edges of the hard well-trodden "squares" of native villages. The lowering of returns inevitable under such conditions has led to an attempt to obtain maximum benefit by soil selection. The shifting agriculturalist does not select soil but forest, that is, he is concerned mainly with finding woodland easy enough to clear with the limited means at his disposal. In the Shire plains all suitable land has been cleared, and with the shortage of fallow crop, specialization has developed so that although bulrush millet and sorghum are commonly planted together the former tends to predominate on the lighter soils of the crowded area south of Port Herald, extending northwards along the "central belt," whilst the latter occupies the major part of the brown loams between the "central belt" and the river. Maize and cotton together dominate the dark soil region of Ngabu. The Amang'anja have distinguishing names for these soil types and for the saline soils on the edge of the Shire marshlands and the patches of highly sandy soil useful for growing groundnuts. Native cultivation in this region is not a haphazard affair, but a system based on an ability to distinguish soils and grasses and the conditions associated with these for crop raising. Great care is often shown in cultivation. In 1915 the Director of Agriculture in Nyasaland wrote:

"The natives of Nyasaland seem to recognize the necessity for this special cultivation and always give more attention to the preparation of the seed-bed

for groundnuts than any other food crop and, for this reason alone, the average results under native garden cultivation are frequently better than in the case of European estates where larger areas are planted under ordinary field conditions especially where the soils are inclined to be heavy." (McColl 1915.)

Another method of obtaining maximum returns has been in the modification of the garden pattern and even of settlement form and siting. The standard method consists of siting the village on a levée with *dimba* on the one hand and *mphala* gardens on the other. The site is well drained and a perennial stream supplies water. However of recent years temporary villages of grass-walled huts have been formed on islands in the Shire marshes. These dry season immigrants to areas temporarily cultivable endeavour to produce a surplus for exchange with a share of a relative's wet season crop and thereby increase the total area cropped. The cost is a seasonal movement combined with house construction, with the advantage that the cropper, who may have little or no wet season land, can offer his labour to the European at a time of labour shortage. On the margins of cropped *mphala* land, in clearings in the semi-arid portions of the Mwanza and Tangadzi basins are "pioneer" cultivators without *dimba* dependent on the rains and on the maintenance of dry season water supplies under the sandy surface of apparently dry stream beds. These people migrate not with the seasons but in periods of years. Whenever the rains are insufficient they must return to the better watered areas occupied by their relatives. Similarly villages are located along the foot of the Port Herald Hills on well-drained fan gravels just at the point where in the dry season surface water supplies disappear underground. The villagers here cultivate the local *mphala*, but share *dimba* with their relatives on the river banks.

The increasing dependence on rainfall with the loss of *dimba* and the extension of *mphala* has magnified the risk of crop failure. The small size of the holdings leaves little margin to cover the variations in yield with variations in rainfall. Precipitation statistics for three stations on the valley floor for the period 1945–50 give yearly means between 28·6 and 33·7 inches with relative variations of 20·8 to 29·3 per cent. Drought with resultant crop failure necessitating government relief has occurred in the Lower River Districts eight times since 1911. The concentration of the rainfall into certain periods of the year and in the form of extremely heavy showers has served to aggravate the soil erosion danger besides turning the tributaries of the Shire overnight from waterless beds to torrents at least 4 feet in depth. Thus rainfall variation and incidence lead to the danger of flooding, on occasions increased in severity by a major rise in the level of the Shire itself. The differing times of high flood of the Shire, Ruo, Zambesi and their tributaries add further to the danger of inundation by the process of "ponding-back." It was in this way that the Linjisi tributary of the Shire burst its banks in 1938 destroying crops in central Chikwawa District.

There are alternatives to agriculture or activities which can be combined with cultivation. Cattle keeping is a recent introduction due to European and Indian influences—no mention of it is made in Livingstone's account of the Lower Shire Valley in 1859. It is not an integral part of the agricultural system and there is at present only one cow or bull to every forty-eight per-

sons. Manure is regarded as useless dirt and its presence in gardens is accidental rather than intentional. Other livestock including goats, sheep, pigs and hens are kept in greater numbers, but depend on scraps for their existence since no fodder crops are grown; there is no attempt to improve stock by breeding. Alternative supplies of flesh are derived from hunting—now much reduced because of overshooting by European sportsmen at the close of the nineteenth century—and fishing. The latter provides activity from December to April for people living on islands in the marshes who combine it with purely *dimba* agriculture during the dry season. Large quantities of fish are dried and sold locally or sent by bicycle or rail to the towns of the Shire Highlands. There is some gathering of wild fruits for relish to enliven the diet, and some local manufacture including brewing and distilling, brick-making, wood carving and iron working. Finally there is employment with Europeans—locally confined on any major scale to the railway company and the cotton ginneries—chiefly in the Shire Highlands or as far afield as Southern Rhodesia and the Witwatersrand. Approximately 10 per cent. of the male population is away from the district, according to official returns. There is, however, a large number of unofficial migrants which would therefore make the proportion higher.

The Shire Valley Project

It is clear that "other activities" are not of sufficient magnitude to contribute a return to the Amang'anja and the Asena comparable with that provided by agriculture. The well-being of these people must depend on their crops and the fertility of the land, yet crop production and fertility are threatened by the changed circumstances which have rendered the practice of shifting agriculture impossible. Interest in native agriculture by the Nyasaland Government was first shown in 1903–4 when an attempt was made to encourage the growth of cash crops by Africans. Cash cropping spread rapidly in Nyasaland, particularly after the decline of European plantation production with the slump of 1929–33. Whilst it has served to supply native cash needs it has possibly fostered an increase in demand for cash threatening the cultivation of food crops, and thus, in the Lower Shire Valley, increasing the risk of famine. The Government has been forced into the apparently absurd position of developing food farms, one of which—the Kakoma Government Farm—is located in the Mwanza basin on land needing deep bore-holes for the supply of domestic water. However, with the promotion of cash cropping came the attempt to study methods of growing the crops concerned and later attempts to improve methods of native cultivation as a whole. In the 1930's, whilst little was done to dam gullies, ridging was enforced on all lands with bunding on steep slopes. In addition, forest reservations were created, and regulations were enforced to prevent stream bank and roadside cultivation and to ensure the destruction of disease ridden crop remains. Programmes of agricultural and crop research were initiated and from these eventually developed the plan now termed the Shire Valley Project.

Much of the research work in Africa has been done by specialists in the various sciences. This has been particularly true of the Lower Shire Valley where the first major work of post-war research was that by Pearson and

Mitchell on the status and control of insect pests of cotton in the Lower River Districts (1945). Their conclusions were that the downward trends of cotton yields in the area were due chiefly to the attacks of the Red Bollworm and secondly to increasing interplanting with food crops resulting from the loss of floodland. Two solutions were suggested: the first, to plant early in order to limit the production of fruit, the food of the larvae, the second, to make seasonal floodland or irrigated land available so that cotton planting would be delayed and the moths would die before food was available from the new crop. In advance of both of these methods prohibition of cotton growing for one complete season would be needed. This last suggestion has already been put into effect. The result was the initiation of a survey to determine the possibilities of reclaiming floodland with the proviso that should reclamation prove impracticable the early cropping method be adopted. Thus the problem of bollworm control becomes basically a question of acreages and changes in the method of cultivation, thereby demonstrating the close linkage of the many problems affecting an African territory and the fallacy of one-sided solutions which must inevitably affect a whole field. Pearson and Mitchell also recommended that the practice of mixed cropping of cotton should be discontinued where there was no scarcity of land. Doubtless for cotton production the effect of pure stand cultivation would be beneficial; but the question of the difference in net return per acre of pure stand cotton and mixed cotton and cereal was not asked. Nor apparently was it realized that mixed cropping is an essential feature of African agriculture and almost certainly represents an adaptation to environmental conditions in terms of non-manuring hoe cultivation as does likewise the size of the African garden and the size of the family cultivation unit.

In 1946 came the report of the Post-War Development Committee (1947). This suggested that the problem of controlling flood water in the Lower Shire Valley be investigated as a logical extension of a project to stabilize the level of Lake Nyasa "partly for the purpose of eradicating the Red Bollworm menace, but more especially in the interests of agricultural production generally." It added: "We doubt whether the acreage cultivated by natives should be greatly increased. The problem is to improve the productive capacity of the land and to maintain soil conservation and it is to be hoped that, in time, the native can be induced to lay down pastures." Thus the problems of the Lower Shire Valley were recognized to be connected with those of the shores of Lake Nyasa, although the phrase "greatly increased" was unsatisfactory in the absence of evidence for the possibilities of or the needs for an increase.

Two years later the Kanthack Report on the stabilizing of the water level of Lake Nyasa was published (1948). In order to solve the problems of changing lake levels the author recommended the construction of a barrage near Liwonde on the Upper Shire. The effect on the Lower Shire, however, would be only a partial control of flooding, since it would be impossible to regulate the flow of the many tributaries below the site or the back-flooding of the Zambesi felt as far up as Port Herald. Moreover it was estimated that the range of discharge necessary to stabilize lake levels would be such that the arable floodland of the Lower Shire Valley would still be subject on occasions to all year round inundation. In addition no dam at Liwonde could prevent

a rise in the Lower Shire like that from 1935 to 1937 which was due to water collected from the basin below that site. Kanthack coordinated his work with that of Pearson and Mitchell by suggesting a survey in the Lower Valley to ascertain levels for the construction of a series of basins which could be flooded in the wet season and dewatered at the end of the rains.

Survey work began in 1951 together with work on the control of the bollworm and on an irrigation project in a small arid triangle of land near the banks of the Shire and immediately south of the Nkombedzi wa Fodya. It was claimed that about 10,000 acres might eventually be involved, watered by pumping from the Shire and devoted to the production of sugar. A second cash crop would assist economic stability although it would do nothing to assist food production. Dry season irrigation of *mphala* land generally would not be feasible at present since the soils can barely withstand the effects of one crop a year, and the cost of pumping would be prohibitive to everything except high value crops. Moreover there is evidence that the subsoil is highly saline with the danger of salt efflorescence. The same danger of salting applies to reclamation. Here the menace is of water-logging on low-lying gardens. Until the task of levelling is completed it is too early to suggest how much of the lost 120,000 acres may be reclaimed. A conservative estimate by the Port Herald Agricultural Officer is that another 10,000 acres may be recovered. If this be all there will hardly be sufficient to redress the balance.

If the plans for irrigation and reclamation succeed there is the possibility of removing all cotton cultivation to floodland and of making up the cash loss of lower production on the reduced acreage by growing sugar in the irrigated area. It has been suggested that the *mphala* land released from cotton be put under pasture, thereby increasing the supplies of milk and meat for which there is a growing demand and making manure available for land improvement. This would be the first real attempt to produce an answer to the basic problem—the adoption of a static system of agriculture. The progressive worsening of soils and of crop type with the consequent reduction in the size of fallow and of gardens might thereby be arrested. Probably a mere fifth of the present *mphala* acreage would as a result of this scheme be available for pasture. It would therefore hardly provide an adequate basis for manuring all crop land, but at least it would be a step in that direction. A considerable redistribution of population will be involved to cultivate the new areas and to make the pattern of pasture land less concentrated, since the cotton lands are to provide fallow and the bulk of cotton land is in Ngabu where soil deterioration is least.

Land converted to pasture will give lower immediate returns. It will be difficult to make the African appreciate the long term advantages of this policy in spite of the desire for more meat and milk. It will be difficult also to persuade the African to use manures. Add to this the question of moving people combined with a much greater degree of control over the uses to which land is put and the effect must be further antagonism to new programmes and to European rule. Any other new development like the extension of the principle of mixed cropping by replacing one of the cereals in the main food gardens by a legume in order to provide a better balanced use of soil must also face this problem. In addition, the new schemes have certain other implications. To increase the number of cattle there will be need of

Gullying at Chapananga, Chikwawa District, mphala gardens on left

Land cleared for burning in the Morrumbala District, Portuguese East Africa: July

Maize and plantation in dimba at Chikwawa, grass covered mphala in foreground: September

capital for the purchase of stock. Better protection against trypansomiasis must also be provided. More dry-season feeding will be needed for the salted grasslands exposed as the level of the Shire drops plus the stubble of *mphala* crops are hardly enough. In this connection it might be possible to develop pastures on *mphala* at present unused because of a lack of domestic water supplies in the dry season. Finally consideration of the population movements necessary leads one to the problem of deciding who will be chosen to cultivate the new lands and the possibility of forced removal against opposition.

Without the success of the schemes proposed the resultant problems will be so great as to be incapable of solution without the drastic removal of part of the population to other areas in Nyasaland or even to other territories. As there is developing a shortage of good agricultural land throughout Africa this last step is becoming increasingly difficult and leads one to the conclusion that the soil resources of Africa are indeed poor at the present level of technique. The need in the Lower Shire Valley is to increase the output of food per man and per acre, and now that the expansion of agriculture appears to have reached its limits any increase of the area under cash crops at the expense of the area under food may prove disastrous. Whilst there is a need for cash it would be foolish to concentrate so much on the sale of crops that food must be imported, for in effect the world is threatened with food shortage and territories like Nyasaland have no great bargaining power on world markets. To assist this, cash might be earned by means other than the growing of crops and thereby release land for food production. The Liwonde barrage is planned to produce hydro-electricity. This power might be used to cut down the import of oil fuels at present used to generate electricity and to promote light industries, particularly cotton textiles and paper manufacture from local reeds.

ACKNOWLEDGEMENT

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FROM THE *JOURNAL* A HUNDRED YEARS AGO

THE FOLLOWING extract is taken from a paper read to the Society by Captain Robert Fitzroy, R.N., on 14 March 1953, under the title: "Further Considerations on the Great Isthmus of Central America," published in the *Journal* 23 (1853) 171–90. In it he discussed the possibilities of a canal across the Darien Isthmus.

"Geographical investigations are, in themselves, so very interesting, that their possible importance in a rather unscientific though a practical point of view may be less present to the mind of a lover of truthful information (for its own sake) than to the keen eye of enterprise. But such comparative indifference to consequences may be valuable in examining a much disputed question, as tending to promote impartiality.

"Interesting and important to the whole civilised world as the Central Isthmus of America has become during the present century, its interest and its importance have been augmented during the last few years in a manner that seems destined to engage a large share of public attention.

"Becoming year by year a greater thoroughfare, more and more frequented by increasing numbers of the migratory and enterprising Anglo-Saxon race, by the carriers of mail-bags and merchandise, and by the bearers of gold, the formidable barrier that so narrow a neck of land still opposes to unbroken and direct commercial intercourse is more and more understood and realised.

"Scarcely had Asa Whitney tried to divert attention from Central America to his startling project for traversing a Continent, when Australian gold demanded instant and definite attention to a more rapid and better mode of communicating with Australasia—since when increasing demand for rapid voyages, and continual improvements in shipping, have irresistibly encouraged the desire to cut through the Isthmus. A spirit of enterprise that India, China, Peru, and even California, scarcely stimulated, has been caused by gold in Australia: and now we see keen interest generally taken in some of the various plans proposed. The interest of geographers in the subject is, therefore, increased by the conviction that their unprejudiced examinations may become immediately useful—a stimulus as satisfactory as beneficial."

THE THEORY BEHIND THE KON-TIKI EXPEDITION

AMERICAN INDIANS IN THE PACIFIC: The Theory behind the Kon-Tiki Expedition. By THOR HEYERDAHL. *London: George Allen & Unwin Ltd.*, 1952. xvi+821 *pages; maps and illustrations.* 70s

AS THE SUB-TITLE indicates, this book cannot be considered except in connection with that great adventure of the twentieth century, the Kon-Tiki Expedition. In the sub-title of an earlier article Heyerdahl himself has referred to the voyage of the raft Kon-Tiki as "an adventurous inquiry into the origins of the Polynesians" (1948). Those are also the best words to describe the present large and initially imposing volume. It is essentially "an adventurous inquiry." And as such it should be judged. What it adds to our knowledge of the origins of the Polynesians is another matter which must be considered separately.

Adventure is not often highly esteemed in the atmosphere of the sciences or the precise academic disciplines. The student in training is advised in his early years to browse freely in the world of books but it is not long before the limiting action of careful organization sets in. His mind becomes disciplined, ending up either as an encyclopedia or a statistical chart. The daring imagination which is buried in both of these is not obvious and it is not the general custom to dwell upon it. Although many have commented upon the fact that the scientist must possess an element of daring and be willing to cut through tradition to fact, many students end up not as scientists at all but as well-trained technicians. The ideal is, of course, to attain precision while maintaining vision, and is easier to specify than to achieve. The actual result of training is too often a semi-atrophy which looks askance upon adventure, even the adventure of ideas. To say of a book, therefore, that it is an adventurous inquiry carries an undertone of adverse criticism which is not intended here.

Heyerdahl conceived his theory that Polynesia had been peopled by migrations from the Americas while he was a student of anthropology. The theory ran counter to much of the published comment on the subject yet the major factual stumbling-block seemed to him to be the lack of transportation facilities westward. The cultures along the eastern rim of the Pacific, from northern California to the Argentine were described as essentially land-locked. If water craft existed, they were said to be incapable of long sea voyages. The secondary sources were unanimous on this point. Heyerdahl went beyond them and found in the primary documentation enough evidence to convince him that the Peruvian balsa raft had been used for ocean travel. He argued from that, quite simply, that the raft must have been seaworthy. What remained was to test the practicability of a westward voyage. This, to put it in its simplest terms, was the course of the adventure. The present volume is a flashback to the beginning and furnishes an elaborate exposition of the theory.

In connection with another great adventure of the twentieth century, Lindbergh's flight over the Atlantic, Cyril Connolly has recently remarked that "heroic deeds are really performed" by "an act of imagination . . . precise and single-minded preparation, practical co-operation from others, and a grain of luck" (1953). The Kon-Tiki Expedition seems to have got under way with a minimum of precise preparation so far as trial runs were concerned—and the

grain of luck turned out to be a sizable kernel. The expedition is unique, however, in that it was not one in a long chain of events: Heyerdahl had no lesson to learn from the successes and failures of any precursors, he was not the first to achieve a feat previously attempted, or imagined, by others. The expedition falls in a quite different order of events from Lindbergh's flight and the conquering of Everest. Yet, like Lindberg, Heyerdahl represents the triumph of the individual over the system. To quote Connolly again, the flight was "the symbolic event" which "stated the post-war conception that the world now belonged to youth, that anything could be done, that money and influence were of no account compared to courage and imagination." The Kon-Tiki Expedition symbolizes another post-war era. Courage and imagination may now have to contend with the authoritarianism of the expert.

As we have moved into the atomic age, the products of science have validated knowledge, sometimes at the expense of scientific principles, and have given peculiar force to the opinions of the knowledgeable. Heyerdahl's achievement reverses this tendency. He has demonstrated most spectacularly that "there is only one sure way of being in the wrong, and that is by asserting dogmatically what is not true." [1] His theory was deduced from observations made during field research in the Marquesas Islands, and from eyewitness and contemporary accounts of Peruvian navigation. It was further bolstered by investigations into the nature of Pacific currents and prevailing winds during which he engaged in library research and interviewed persons with first-hand acquaintance of conditions. He accepted fact, and recognized and rejected opinion. In all of this he followed the best precepts of anthropological research. The present reviewer once asked an anthropological field worker if such and such behaviour occurred in the region from which he had just returned. "The natives say so," was the reply, "but I know better." Now, this is a tempting attitude, but there is no room for it in valid anthropology. So many of the areas of our investigation are new that much of our time must be spent in testing the validity of our inherited scholarly assumptions. In doing so, we must be courageous enough to evaluate the implications of the native's statement, and the primary source, on a par with accepted generalizations, however often the generalizations may have been repeated. Heyerdahl had this courage. The raft was built "on the general principles recorded in the early European eyewitnesses reports . . . and Watzinger, who was in charge of the construction, collected whatever evidence was still obtainable from old people in various parts of the Guayaquil region of Ecuador and further down along the desert coast of Peru . . ." (p. 602). Actually, there was an almost slavish insistence upon the validity of anthropological method. If the raft proved seaworthy, it was for reasons unknown to the navigators until they were in mid-Pacific. The *guara* or centre-board was built in, although its true use was unknown: the full extent of its influence was only realized when the journey was over. Anthropologists and marine experts united in regarding the voyage as an impossibility. But Heyerdahl imbued others with his scientific faith, and followed his data across the Pacific.

This aspect of the Kon-Tiki Expedition is dwelt upon here because it is not the one which comes out most clearly in 'American Indians in the Pacific.' Heyerdahl himself places greatest emphasis upon his theory as such. When first presented in manuscript form in 1939 and again in 1945, it was rejected by anthropologists and publishers alike. After the success of the Kon-Tiki Expedition in 1947—and, later, the published account of it—the theory was not only accepted for publication but awarded the somewhat dubious accolade of its present excessively expensive format. There is justification in this for some

[1] E. S. C. Handy, quoted by Heyerdahl (p. 8).

bitterness. And in one sense, Heyerdahl seems to value the success of the expedition mainly as the means through which attention could be riveted upon the theory.

It is surely ironical that, after all this, anthropologists still generally reject the theory. Having made such a statement, it will perhaps be as well to go in some detail into the reasons why this may be so.

One of the first well-tested hypotheses of anthropology was that postulating the origin of the American Indian in Asia and his migration to the New World via Bering Strait. Various suggestions as to the number and dating of migrations or infiltrations of people have been made, and the period of their early arrival has gradually been expanded from roughly ten thousand years ago to four or five times that. Their exact places of origin are still also unclear. Yet the exhaustive research of three generations of anthropologists working in ethnography, archaeology, linguistics and physical anthropology has furnished masses of evidence substantiating the hypothesis. The most important corollary of the hypothesis has been that which states the basic isolation of the relatively high civilizations of Mexico and Peru at the time of the conquest. Starting from the simpler stages still in evidence in other parts of the New World, these civilizations developed their arts independently, without access to similar developments elsewhere. The implications of this for theories of cultural development are obvious. It is now so well established, however, that one easily loses sight of the opposition which it met in nineteenth century social philosophy. There was also opposition at one time from men using the anthropological frame of reference and emphasizing the role of diffusion in the development of culture. An extreme example of this was the heliolithic theory of Elliot Smith (1924) and Perry (1923) which transcended ordinary considerations of time and space and posited the original source of all high culture elements, even in the Americas, in Egypt. The simplest and most telling argument against such extreme diffusionism was found to be the width of the Atlantic from Puerto Rico to Portugal and of the Pacific from the Galapagos to Asia.

If the high cultures of the Americas were built upon borrowed elements from other parts of the world, how had they entered the Western Hemisphere? They had certainly not come across Bering Strait. Either this problem was avoided, as by Perry, or the lost continents of Atlantis and Mu were quoted as convenient land bridges. The respectability of Atlantis as a cultural bridge was difficult to maintain against the full weight of recorded history which left western Europe devoid of high civilizations until a very recent period. A belief in Mu, however, could be nourished with greater equanimity, and is still, I believe, cherished by some.[1] The more straightforward device was to send boat loads of men across the Pacific carrying their arts with them. A recent suggestion of this sort comes from Gladwin (1947), who salvages the lost boats of Alexander the Great, sees them setting sail from the mouth of the Indus and landing on the west coast of Mexico. To-day such suggestions are not taken, and are perhaps not intended, as serious contributions. But in the earlier years of our century when the whole process of cultural development was gradually being understood in other terms than those of unilinear evolution, the independent growth of American native civilizations was a matter of no little concern. The new science was already contending with the social philosophers. To be attacked from its own ranks on a point where the evidence was so plain—and so plentiful—aroused the ire of the most scholarly. Mention of boats across the Pacific is still capable of setting off a barrage of anthropological comment which

[1] Although, needless to say, no recognized anthropologists are among them.

must be puzzling to those from other disciplines who are unfamiliar with this background.

Extreme diffusionism had relied to a great extent upon visual similarities. Wherever these could be discerned, however distant from each other, they were taken as proof of previous migrations or direct contacts. Careful studies so often exploded the likenesses, showing them to be more apparent than real, that scholars came to slight wide distributions, especially of single, visual traits, and concentrated upon clusters of associated traits from various fields of man's complex life. Diffusion was not necessarily neglected. But it was recognized as only one of several cultural processes and the rigours demanded of diffusion studies were greatly increased.[1] Not only had likenesses to be specifically indicated but the historical sequences by which they had been maintained had to be worked out. The ready answer was no longer acceptable.

Heyerdahl and Heine-Geldern have exchanged views in the pages of this *Journal* and gone to some lengths in the analysis of details to substantiate their theses.[2] To assess this exchange it must be realized that Heine-Geldern is the exponent of a theory which points to similarities between the cultures of Mexico and the mainland of Asia. He sees all of the connections moving in one direction, from Asia to the New World. The theory was first presented by him and Ekholm (1951) and has since been elaborated by Ekholm (1953). Most of the materials upon which it is based are visual in character, falling "largely in the realm of religious art and architecture," [3] and it depends upon the feasibility of "actual ship navigation of the Pacific." [4] Ekholm has worked from knowledge of Mexican archaeology and states his hypothesis of Asiatic influence in Mexico as an explanation for traits which have not yet been satisfactorily accounted for by New World developments. He is fully aware that he has been "forced to take sides" when he argues "on the *pro* side of transpacific contact." [5] Heine-Geldern works from a more purely diffusionistic view-point—he is a member of the Vienna school—and he has given more attention in his general work to tracing distributions from Southeast Asia into Indonesia and the Pacific. Quite apart from the accuracy of details, which is a subject that can be itemized indefinitely, Heyerdahl and Heine-Geldern place equal reliance upon the diffusion of unassociated traits to the exclusion of other cultural processes.

If neither of the theories of Heyerdahl and Heine-Geldern can be accepted *in toto*, how do some of the anthropologists not mentioned here stand on this question of transpacific contacts? In the first place, there is no doubt that resemblances in practice exist in areas separated by the Pacific. Some of these, such as the making-of-man cult, are elaborate complexes of associated phenomena; some, like self-torture by hanging from pegs thrust under the muscles of the back, are simpler and may, when fully examined, prove to have quite different histories. In either case, the more striking resemblances are those which relate Melanesia or continental Asia with *interior* sections of the Americas. Thus the problem is even a greater one than that of bridging the Pacific.

On the visual side, apparent likenesses can be found in many places. A peculiarly stylized facial form appears in human sculptures, for instance, in

[1] Spier (1921) may be cited as a classic example of a well-controlled diffusion study. Archaeology, of course, also works largely in visual materials but the rigorous demands of the best archaeological studies can hardly be equalled.

[2] Heyerdahl (1951); Heine-Geldern (1951, 1952).

[3] Ekholm (1953, p. 88).

[4] *Ibid.*, p. 89.

[5] *Ibid.*, p. 72.

Bihar, central India,[1] among the Coast Salish of the west coast of Washington State,[2] and among the Cuna Indians of eastern Panama.[3] It is unlike facial forms employed in other sculptures of these regions and there is no proof that it developed locally. Does such a circumstance indicate migrations or direct contacts between these distant regions? And if so, who is to say on these data alone what the direction of contact might have been? In our present state of ignorance about the developmental forces in art styles, it is clearly rash to draw any conclusions at all from such materials. Yet the problem remains. It is, however, a problem in art history as much as in diffusion.

Many anthropological problems are of this nature. The question of bearded physical types among natives on both sides of the Pacific, to which Heyerdahl calls attention by paralleling photographs and artistic representations, is thus not as simple as some of his statements might suggest. It is tied with the presence of hirsute, light-skinned peoples in northern Hokaido and of hirsute, dark-skinned peoples in Australia. It is part of the larger problem of the inheritance of this physical trait and its linkage with other characteristics, of the whole problem of the racial history of mankind.

Mindful of such factors, anthropologists have tended in the last decades to become experts on certain areas and on certain problems. Heyerdahl is quite right when he grows restive under the limitations this imposes. Although many papers however seem restricted in statement, their authors are working with the larger problems in mind. Despite this, there is often an unfortunate tendency toward the narrow view. Criticisms are levelled against such an hypothesis as Heyerdahl's in terms of expert knowledge of relatively small segments of data. For instance, in 'American Indians in the Pacific' Heyerdahl introduces a new angle to the theory behind the Kon-Tiki Expedition in the form of a long section on apparent connections between Polynesia and Northwest America. This reviewer, having become "expert" on the Northwest Coast, could spend considerable time in developing the fact that hardly a statement concerning the Northwest in this section of ninety pages is both accurate and complete. For all that, the hypothesis that one band of Kwakiutl Indians left their homeland by boat and landed in Polynesia may be true. The evidence is not, in my mind, of the sort which either proves or disproves the hypothesis. Even if we are to accept that some Peruvians went by balsa raft to Polynesia, and some Kwakiutl by cedar dugouts to the same islands, this does not people the whole of Polynesia in the face of other data showing an eastward drift of peoples in the Pacific. And, finally, the hypothesis by-passes many of those larger problems to which anthropologists must contribute if the broader view is to be successfully maintained.

It is strange that this book, involving geography to the extent it does, contains no map of the Pacific area. One is listed as appearing on page one but it is nowhere in the copy of the book I have seen. Yet that may be coupled with what I cannot but consider the awkwardness of the whole format from the publishing standpoint. Considerations such as this should not prejudice one against Heyerdahl or his hypothesis. At his best, Heyerdahl writes with well-considered caution. He shows himself capable of the best use of data and argument. At his worst, he uses doubtful sources excessively while omitting standard ones: thus error and weakness tend to pile upon one another. Yet always there is the broad vision. And to follow his exploits in expounding his

[1] Archer (1947): plates 13, 14, 44, 45.
[2] Wingert (1949): plates 2, 9, 18, 19.
[3] Stout (1947): plate 13.

theory is as exciting—and as nerve wracking—as if one had ventured with him on to the raft Kon-Tiki. His greatest contribution up to the present time, and it is not to be underrated, lies in the challenge to the experts which he so magnificently formulated on the basis of their own best methods.

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THE SUDAN IN TRANSITION

THE MAKING OF THE MODERN SUDAN: The life and letters of Sir Douglas Newbold, K.B.E. By K. D. D. HENDERSON, C.M.G. With an Introduction by Margery Perham, C.B.E. *London: Faber & Faber*, 1953. $8\frac{1}{2} \times 5$ *inches;* xvii + 601 *pages; maps and illustrations.* 30*s*

WITH THE TRANSFER of full powers to an independent Sudanese Government the Anglo-Egyptian Sudan of the Condominium will pass into history, and it is to be hoped that it will find an historian worthy of the theme, who will bring the detachment of the scholar to the evaluation of the part played by the alien rulers in the making of the new Sudan. When this history comes to be written the letters of the late Sir Douglas Newbold will contribute important source-material for the period of transition from tutelage to self-government. Primarily a simple record of personal experiences and reflections, set down without pretence to literary graces, they are memorable as the self-revelation of an able administrator dealing empirically with day-to-day problems and groping his way towards a philosophy of racial and political relations in a multi-racial Commonwealth. In addition to the letters there are a number of lectures and memoranda of a more formal kind.

The training of political officers in the Sudan, during the formative years of the Service, did not lead to professional expertness in administrative technique but it set high value on the ability to approach practical problems with common-sense and with sympathetic understanding of the people entrusted to the officers' care. To say, therefore, that it produced a team of amateurs in the art of government, is not to disparage a body of men whose qualities were shown to greater advantage in their personal influence on the people they ruled than in the mastery of bureaucratic procedure or in the neat phrasing of despatches. The weakness inherent in this tradition was a tendency to parochialism which rendered district commissioners and provincial governors impatient of the centralizing policy of Khartoum while, on a higher level, the importance of external political factors affecting the status of the Sudan was not fully appreciated.

The Newbold papers throw light on three phases through which the Condominium has passed in its brief history. When the writer joined the service in 1920 the country was still administered under the authoritarian system instituted by General Wingate and his collaborators. It had recovered from the chaos of the Mahdiya and it benefited from high standards of efficiency and integrity, but the development of economic resources on a large scale had not gone beyond the planning stage, and progress in education and social services was retarded by budgetary stringency. The patriarchal societies of the north and the primitive tribes of the south had not felt the impact of western ways to any serious extent, and the authority of the government was not challenged by a politically-conscious class. The small number of educated Sudanese occupied relatively unimportant posts in the government service.

The second phase brought momentous changes compressed in a brief span of time. The rapid success of the Gezira scheme of irrigation provided funds for social betterment and education. Mechanical transport and aircraft revolutionized communications. An educated class, growing swiftly in numbers and in importance, was stirred into political consciousness by events in Egypt and the climate of the post-war world. As late as 1934 Sir Harold MacMichael

estimated that the classes capable of taking an intelligent interest in the outside world counted no more than 12,000 persons, and only a very few Sudanese had by that time acquired a post-secondary education. Yet an educated élite had now learned to speak the language of "national aspirations," and it cautiously expressed criticism of a régime which offered but little prospects of advancement to their own class. Meanwhile important changes in the administrative structure were brought about by a new policy of "devolution" under which judicial and magisterial powers as well as functions of local government were entrusted to tribal chiefs or to elected boards. These new organs of local government were conceived as training-grounds for national self-government which, at this stage, seemed only a vague possibility in a somewhat distant future. The increasing restlessness of the politically-minded group found expression in the activities of a "Graduates' General Congress" which thought of itself as a potential parliament and claimed the right to be consulted on matters of public interest.

The outbreak of the Second World War ushered in a third phase in which events moved rapidly and irrevocably towards a new conception of the relations between the British administration and the Sudanese people. The Sudan, hitherto a "colonial" backwater absorbed in its own problems, suddenly became strategically important as a centre of communications, while the proximity of strong Italian forces created urgent problems of defence. At the same time the administration, ruthlessly depleted by the secondment of officers for service in other theatres, had to deal with a new spirit manifested by the members of Congress who, inspired by the Atlantic Charter and the example of India, demanded an effective share of political power and the issue of a declaration granting to the Sudanese the right of self-determination after the war. These proposals were coolly received by the Government which, in principle, refused to recognize the claim of Congress to represent the country, yet a stage had been reached by imperceptible steps in which the conversion of "trusteeship" into "partnership" could be advocated by Newbold as an immediate aim. From a note submitted by him to the Governor-General's Council in 1942 and reproduced in the 'Life and Letters', it would appear that it was largely his personal influence which inspired a series of measures intended to promote the policy of training the Sudanese in the art of self-government. With this end in view there was rapid progress in the "sudanization" of the civil service and the extension of opportunities for higher education.

Newbold's political thinking hovered uneasily between sympathy with the aspirations of the educated élite and the conviction that the time had not yet come for the Sudanese to assume full control of their destinies. He hated the colour-bar and, both in principle and in his practice, he favoured the admission of the Arab to "social equality" with the European. He thought of the northern Sudan as part of the Arab world, and he spoke of the Arabs' desire for political freedom as natural and laudable. He knew that independence was bound to come, yet he thought that British guidance was still desirable in the interest of the Arabs themselves. He put his faith in some change of heart that might result from personal friendships between individual Arab "effendis" and young Englishmen, and he believed that "an Arabic-speaking cadre of British officials, advisers, political officers, etc., with a training in Islamic and Arabic history and customs and thought" would have a beneficent part to play in the Middle East. He seems to have underrated the emotional force of Arab nationalism to which the sweet reasonableness of a gradual progress towards independence made no appeal, and he could not foresee the events which ruthlessly cut short that period of British guidance which he envisaged for the Sudan. The conflict

with Egypt had not, in Newbold's lifetime, taken that acute form which later led to the denunciation by Egypt of the 1936 treaty and the assumption by the Egyptian monarch of the title of King of the Sudan. Newbold had little respect for a country which he stigmatized as "corrupt, diseased, self-seeking, incompetent and faction-ridden," and he held that Egyptian domination, and even a close link with Egypt, would not only be detrimental to the interests of the Sudanese but arouse strong feelings of resentment and resistance. It is one of the ironies of history that it was the intervention of General Muhammad Neguib's new Egypt which accelerated the pace towards the recognition of Sudanese independence by both partners in the Condominium. Newbold died prematurely in 1945, and it was left to his Editor to record the later events in a postscript.

It would be unfitting to claim for Newbold qualities of statesmanship and political foresight which he himself would have been the first to disclaim. He drew his strength from the traditions of the service to which he belonged, and from his gift of human sympathy which found a ready response in those over whom he was set in authority. Though he spoke scornfully of the "Kipling complex that the young Anglo-Saxon ex-public school boy is divinely inspired to lead or rule the peoples of the East by the light of nature," he might have claimed affinity with some of Kipling's impeccable sahibs, if only their creator had endowed them with Newbold's intellectual gifts and his respect for the things of the mind. His innate ability was nurtured by wide reading, and by the habit of reflecting on the wider issues involved in his daily tasks.

The informal letters are pervaded by a sense of impish fun and a light-hearted zest for life. Could there be a better account of pre-logical reasoning than the defence put forward by a Hadendawi camel-thief: "I didn't steal the camel. When I stole the camel it wasn't this camel. Anyhow he stole my camel. Had we stolen each other's camels, the camels would not have been these camels. Let the government decide as it sees fit." It is permissible to wonder how the ingenious tribesman will deal with voting-papers and ballot-boxes.

Miss Margery Perham has written a discriminating introduction, and the editor has contributed helpful notes and additions to the narrative. The book well deserves a place in a series devoted to "colonial and comparative studies," as a fitting memorial to the man and as a contribution to history.

S. HILLELSON

REVIEWS

EUROPE

THE FOUNDING OF THE SECOND BRITISH EMPIRE, 1763–1793. Volume I. Discovery and Revolution. By VINCENT T. HARLOW. *London: Longmans, Green & Co.*, 1952. 9½×6 *inches;* viii+664 *pages;* 6 *maps.* 45*s*

The constitutional history of eighteenth century England, long dictated by the great Whig historians, has been rewritten in our day, largely by Oxford scholars under the inspiration of Sir Lewis Namier. Working in this tradition, Professor Harlow here reinterprets the history of 'Britain overseas' during the first half of the reign of George III. This period embraces the disintegration of the old colonial empire, founded upon settlement and plantation, and the growth of the concepts upon which a new commercial empire was to be constructed. The evolution of imperial ideas is traced in the methodical British "siege of the Pacific," in the projecting of an "empire of oriental trade," in the diplomatic settlement with America, and in attempts to regulate Anglo-Irish relations. The author's treatment of these themes endows his book with special interest for geographers.

Professor Harlow rejects as "too simple, too catastrophic" the conventional version, which closes the account of British imperial expansion at the collapse of the First Empire in 1783 and does not reopen it until the middle of the nineteenth century. Searching for continuity, he sees the process of founding the Second Empire initiated some thirty years before the breakdown of the First and pursued without interruption. The sequences of events are convincingly woven into the texture of his argument to produce a picture of organic growth.

In the first part of the book the author describes the extension of England's search for new markets and the attempt to create "a network of trading posts" in the Pacific and Indian Oceans and the China Sea. British commercial expansion in the Far East and nautical enterprise in the South Atlantic and Pacific not only broke into the Spanish "maria clausa" but also pioneered the way for a "commercial empire based on alliance with coloured peoples instead of settlement by European colonists." An essential corollary was the growing appreciation of an "oceanic system of defence," pivoted on strategic bases for the exercise of naval power.

The second and longer part of the book offers a reassessment of British diplomacy after the American Revolution, followed by a study of relations with Ireland as an element in "the changing compound of imperial experience." It was no less the commercial rivalry of New England, developed behind the shield of British sea-power, than the political revolt in America that discredited the practice of colonial imperialism. The failure "to run Ireland as a Crown Colony" pointed the same moral. Professor Harlow's absorbing narrative of the negotiations leading up to the Treaties of Versailles (1783) demonstrates that Shelburne ("that profound statesman," in Disraeli's phrase) significantly subordinated territorial expansion to "the instruments of maritime commerce —sea power, strategic bases and freedom of the seas." It was Shelburne who coined the cry of the new imperialism, "We prefer trade to dominion."

This exhaustively documented and lucidly constructed study reconciles the disciplines of history and geography with rare dexterity. Professor Harlow's earlier chapters tellingly relate geographical enterprise to the social circum-

stances and political objectives of its time. Explicit documentary evidence of a "grand design" behind the successive voyages of English navigators into the Pacific under George III remains indeed scanty, but their continuity of purpose, culminating in the achievement of Cook, is convincingly displayed. Cook's rival Dalrymple, whose foibles have too often obscured his ability, is also seen as an apostle of "the new imperialism," urging the advantages of discovery—"not with a view to colonising; not with a view of conquest; but of an amicable intercourse for mutual benefit." The opening of trade with the Pacific was a project which anticipated the dawn of the Old Empire and survived its eclipse, and the control of trade routes was ultimately to supplant the acquisition of land as the motive of British policy overseas. R. A. S.

WEST DURHAM: A study of a problem area in north-eastern England. By G. H. J. Daysh, J. S. Symonds and others. *Oxford: Basil Blackwell*, 1953. 10×6 *inches;* x+198 *pages; maps and diagrams.* 45*s*

This book defines West Durham as the part of County Durham, 500 square miles in extent, that lies west of the Great North Road. A century ago this area between the Tyne and the Tees held a scattered population of 50,000, but to-day it contains over 300,000 persons living in small isolated communities around the mines and producing about 13 million tons of coal a year. Before the war West Durham endured grim years of extreme economic depression and was officially designated as a "Special" area; to-day it is one of the Development Areas and as such is subject to special legislation. In the early 'thirties of this century its coal resources were dwindling: seams had been exhausted, some pits were flooded and there were few alternative forms of occupation for the mining population. In 1932 no less than 45·8 per cent. of the area's insured workers were unemployed. There is a haunting fear that unemployment might once again overwhelm this part of England, and it is largely for this reason that the Nuffield Foundation has financed this inquiry into the complex economic problems of West Durham.

The policy of Government both before and after the war has been to stimulate industrial revival in West Durham by establishing trading estates, now more accurately known as industrial estates. The introduction of new industries into the area and more especially the suitability of North-west Durham for industry are carefully analysed in this report. The alternative policy of encouraging the migration of population from West Durham to more prosperous districts is also considered, but the general conclusion of the authors of the report is that "large-scale migration must be regarded as a desperate measure to be adopted only as a last resort."

The report was prepared by the Northern Industrial Group under the editorship of Professor G. H. J. Daysh, chairman of its executive committee. It appears from the preface that "most of the responsibilities of the actual investigation and of the writing of the report" have fallen on Mr. J. S. Symonds, whose name appears on the title-page. The part which deals with the social character of the area, including its settlement pattern, is of special interest to geographers; and credit must be given to Miss A. P. Jephcott, who is apparently the author of a valuable chapter on travel to work, but whose name is unfortunately not included on the title-page. The whole report is a notable contribution to "the fundamental problem of how far there should be intervention in the natural process of economic growth and decay." The arguments of the book are supported by batteries of statistics, but in spite of these formidable tables it remains a readable document. It is well illustrated by maps, diagrams and a few illuminating photographs, but there is no index. E. W. G.

THE HEART OF NORWAY. By FRANK NOEL STAGG. *London: George Allen and Unwin*, 1953. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 194 pages; end-paper maps and photographs.* 18*s*

Writing on the history of Norway's central provinces, Commander Stagg has adopted a similar approach to that used in his earlier history of North Norway. Dealing with the hinterland of Trondheim—in many respects a focal area in that country's history—he devotes five of eight parts of the book to outlining events from the Ice Age to the struggle for independence in the nineteenth century. Some twenty to thirty pages are given to each of the five periods: before 1066; 1066 to 1240; 1240 to 1523; 1523 to 1660; 1660 to 1814. The remaining three parts give a good guide-book impression of the area by devoting about the same space to each separate county.

A wealth of minor detail is found pressed between accounts of major historical events that follow one another in rapid succession. Parenthetic excursions in time and minute asides for local and biographical anecdotes show the author's reluctance to deprive us of the fruits of detailed research. The evidence of the Sagas is used extensively in the earlier stages, but more source references would have been welcomed. The list of rulers, temporal and ecclesiastical, given at the end is certainly indispensable for anyone not fully steeped in Norwegian history.

A brief and general geographical setting introduces the prehistory but, in spite of the encouraging appearance of a map on both end-papers and the inclusion of excellent landscape panoramas amongst the illustrations, the author concentrates mainly on the personalities in the historical scene. He leaves room only for glimpses of those essential regional variations stressed by the Bishop of Trondheim in his foreword—perhaps because the rulers and traders often forgot those, such as the "birchlegs" (p. 32), who were more closely in contact with the harsh environment.

Geographers will appreciate sidelights on movements of population and settlement (p. 53); the significance of the changing balance between isolation from, and contacts with, other parts of Norway and the rest of Europe (pp. 55, 96); the brief mention made of the "Domesday" *Jordebog* (p. 61); paragraphs on trade and commerce (pp. 68, 90, 104, 178) and on mining especially at Børos (p. 120); the burning problem of fire in the planning of timber-built cities (p. 103); the expulsion of able-bodied adults from towns after the Black Death to prevent the "drift from the land" (p. 165); rivalries between the regional capital, the *sjølenane* (coastal districts) and the *ladesteder* (loading places) (p. 118 *et alia*); but would wish for more detail on the valley settlements.

The byways of history in the counties (Parts VI, VII and VIII) give more detail of regional affinities and development. No pulling together of the strands of history is called for by such treatment, but ending in *Nordmøre* and *Romsdal* with their many English and Scottish associations, is sufficient satisfaction for the reader in English. E. P.

EUROPE. By SAMUEL VAN VALKENBURG and COLBERT C. HELD. 2nd edition. *New York: John Wiley (London: Chapman & Hall)*, 1952. $9\frac{1}{4} \times 6$ *inches;* xiv+826 *pages; maps.* 60*s*

Van Valkenburg and Ellsworth Huntington's 'Europe' was first published in 1935, and went through several printings. It now appears in a second edition with a new co-author and largely re-written. The basic design, however, remains the same. The early chapters describe the climate, structure and main natural regions as a whole, to form a basis for succeeding sections on soil, vegetation, commerce and population. The second part outlines the regional geography and the present day economic problems of the political units. Even in a volume

of eight hundred pages, this theme necessitates a considerable amount of generalization. The treatment of climate and the development of civilizations still embodies the ideas of Ellsworth Huntington, *e.g.* in the migration of centres of civilization towards "cooler and stormier climates." The whole truth of conditions in Sicily is surely not contained in the statement "the Sicilians, not yet having learned to protect themselves properly, shiver, suffer and die in temperatures that seem warm to the Swedes." The course of Irish history is explained almost entirely by climatic fluctuations.

The main purpose is to "analyse the fundamental bases of the remarkable role that Europe and Europeans have played and are playing in the fascinating drama of mankind." The studies of the individual countries are written sympathetically as a contribution to international understanding. As an introduction to its subject, the book will awaken interest and stimulate students to further inquiry into some of the many questions it poses. G. R. C.

ASIA

SEVEN YEARS IN TIBET. By HEINRICH HARRER. Translated from the German by Richard Graves. *London: Rupert Hart-Davis*, 1953. 9×5½ *inches;* 288 *pages; photographs.* 16*s*

The author of this fascinating book was one of Peter Aufschnaiter's party which reconnoitred the Diamir side of Nanga Parbat in the summer of 1939. After reaching Karachi towards the end of August and unable to leave India by boat the party was "picked up" in the little state of Las Bela whence they had hoped to get back to Germany. It is not to be expected that men who have once enjoyed the freedom of the Himalaya would long remain behind barbed wire, and after one failure to break away from their first camp at Ahmednagar, and a second attempt from Dehra Dun when Harrer roamed the Himalaya for twenty-eight days, seven of them escaped again in April 1944. Two took the train to Calcutta and five made northwards into Tibet. Two of this party—Sattler and Treipal—turned back within two months; the other three, Aufschnaiter, Kopp and Harrer, after being escorted back from Hanle in Tibet by the Shipki pass into India, broke back into Tibet, reached Gartok, and by various devices gradually made their way eastwards, mostly by the old southern trade-route by Lake Manasarowar and down the Tsanpo to Tradun. At Kyirong, almost on the Nepalese border, they were detained for ten months (January to November 1945), while trying to obtain permission to continue eastwards to Lhasa, but always with the fear of being ejected into Nepal and thence back to captivity in India. Here Kopp had had enough and returned to India by Nepal. Aufschnaiter and Harrer spent much of the time exploring the surrounding country. In this "happy valley" on the Nepalese frontier there are villages and well-cultivated fields and forests of oak, pine and rhododendron on the mountain-sides. In all directions superb mountains rise to great heights. Sherkam Kang, 24,500 feet, Dayabhang, 23,750 feet, and many others over and around 22,000 feet. The two were allowed considerable freedom after June, and made the best of it by sketching and map-making. Dhaulagiri and Annapurna are not far distant but were of course "out of bounds."

On November 8 they left Kyirong and crossing the Tsangpo at Trashigang made their way into the desolate province of Changthang. They encountered severe hardships here (the average day temperatures are about 35° F. below freezing-point in December), had some narrow escapes from the robber Khampas, and crossing the Nyenchenthanglha range and the Gurung La

reached Lhasa on 15 January 1946, almost barefoot, with one tola of gold sewn into their rags, a rupee and a half in cash, and their few remaining belongings on a donkey.

This first two years of Harrer's story is absorbing enough, but it is only the prelude to five years of intense interest spent in Lhasa. In daily fear of being returned to India, they gradually won the confidence and friendship of the Lhasa authorities. In their travels they had gradually mastered the Tibetan language and now applied themselves to perfect it and to learn Tibetan customs thoroughly. This was the secret of their success. The Tibetans began to make use of their skill in various ways—drainage, engineering, water-supply, improvement of roads, irrigation of gardens, and even a town plan of Lhasa, all came within their scope. Friendship with the mother and brother of the boy Dalai Lama led to many favours and eventually Harrer became the confidant and tutor to the Dalai Lama himself—a position he held until the advent of the Chinese in October 1950.

Harrer has an extraordinarily interesting story to tell of these years in Lhasa; he and Aufschnaiter, whatever their feelings about barbed wire in Dehra Dun, were lucky in their "leisure" for study before setting out; they arrived in Lhasa as penniless pilgrims, like any Buddhist from Western Tibet might arrive. They thus started their life in Lhasa at the bottom of the social ladder, and by simplicity and good sense won approval and affection among the lay and court officials, and more than tolerance among the abbots. This was an outstanding achievement, and in some respects they came to understand the Tibetan outlook on life better than anyone appointed as an official from outside could ever hope to do, because of the mutual trust that existed between them and their hosts. The book contains many superb illustrations, the translation is very well done, and the publisher is to be congratulated on so fine a production at so moderate a price. K. M.

DIE ERFORSCHUNG PERSIENS; die Entwicklung der abendländischen Kenntnis der Geographie Persiens. By ALFONS GABRIEL. *Wien: Verlag Adolf Holzhausens*, 1952. $10\frac{1}{2} \times 7$ *inches;* viii+360 *pages; maps and illustrations. DM.*16.50

This is a detailed and comprehensive survey of the routes and researches of European travellers in Persia, from the time of Alexander the Great until the present day. Dr. Gabriel has himself travelled extensively in Persia, particularly in the Lut desert and Baluchistan and has worked for many years on the history of its exploration. The arrangement is chronological, and the text contains summaries of the travellers' achievements in their contemporary settings, with estimates of the value of their work.

Attention is given mainly to those who have elucidated problems of topography and physical geography, but in the later chapters reference is made to archaeologists, geologists and other scientists. General writers and students of politics have been excluded. At the end of each chapter, the relevant bibliographical references are given, a very useful feature. The index contains some three thousand entries, of which a large proportion are personal names. Full justice is done to British travellers from the sixteenth century Anthony Jenkinson, but the author laments the present difficulty of obtaining details on Russian work.

This carefully compiled and comprehensive work should be of great value to all students of Persia. G. R. C.

INVITATION TO AN EASTERN FEAST. By AUSTIN COATES. *London: Hutchinson*, 1953. 9×6 *inches; 270 pages; illustrations.* 21*s*

THE VERMILION BOAT. By SUDHIN N. GHOSE. *London: Michael Joseph*, 1953. 8×5 *inches; 302 pages; illustrations.* 18*s*

These two books are linked by the intense interest which Mr. Coates, the author of 'Invitation to an eastern feast,' takes in the Bengali way of life and the extremely vivid description which Mr. Ghose gives of the reactions of a young man from the country to life as a student in Calcutta.

The strong points of Mr. Coates' book are the delightful accounts of meals he has eaten in various countries of the East and the comparisons he makes between them. He draws a very tempting picture of how well one can feed in that part of the world, if one is willing to leave the great hotels and their bacon and eggs for breakfast and to sample the indigenous forms of cookery. His description of the difficulties which face one like himself, who wishes to be accepted as one of the family in a Bengali household, and his ultimate success in doing so, makes very interesting reading and contrasts with his failure to do the same in China, although this is probably due to the fact that his sympathies and interests all really lie with his first love, Bengal. He is however much less effective when he is dealing with more general matters and, despite his sincere desire to become one with his hosts even to adopting their dress and customs, his knowledge of the Indian way of life is slightly superficial, the more so because where he speaks of Indian, it would really seem more correct to say Bengali. It is probable that time was against him, since more than social intercourse is required if one is to speak with authority about that vast concourse of races, which is India, and many, who have not gone to the lengths to which Mr. Coates went, have acquired a more intimate knowledge than he.

'The vermilion boat' has great charm. It is written in an autobiographical style and in the most delightful English. Mr. Ghose is particularly interesting when he writes of life in his grandmother's house in Chandernagore and the way in which the past continually obtrudes itself upon the present. His contrast of the honest and sincere advice which he receives from his village pandit with the worldly and dubious philosophy of the self-appointed leader of the latest fashionable sect is most effective and his struggles against Communist students give a fine picture of a somewhat inarticulate young man, who knows what is right, but is unable to convince the more sophisticated town-dwellers of the fallacies which are shrouded in a cloud of words and appealing slogans. His introduction to the seamy side of student life is balanced by his touching love affair with his Anglo-Indian Latin teacher and his struggles to solve his psychological problems make a remarkably interesting study.

Both books were a pleasure to read, but Mr. Ghose has the advantage of real knowledge and the fact that he is writing of his own people, whereas Mr. Coates is always an Englishman striving to be a Bengali, but never quite succeeding. J. E. F. G.

AFRICA

ATLAS OF SIERRA LEONE. *Freetown: Survey and Lands Department*, 1953. $10\frac{5}{8}\times15\frac{1}{2}$ *inches;* iv+16 *pages.* 12*s* 6*d*

The Survey and Lands Department, Freetown, has rendered a useful service in publishing this Atlas. Here, for the first time, we have a number of authoritative maps of the Colony and Protectorate brought together, while some useful general information is presented at the end of the Atlas.

Some of the maps are both useful and well executed. Among these must be

included the physical and soil maps; the political and population density maps; and those showing geology and mineral deposits; while the map labelled (not altogether correctly) "Colony" is pleasing, though rather sparing in information. For instance the vertical interval is coarse (500') and there is insufficient differentiation between varying grades of road. On the other hand some maps are frankly poor. Into this category must fall the one showing agricultural products, which attempts with notable lack of success to show the distribution of no fewer than ten commodities. The township maps at the end of the atlas, useful though they are, have a crude appearance, with the exception of that of Bonthe, largely owing to the representation of motorable roads in a heavy red, while it must be remarked that the accuracy of the map of Freetown, at least, in this respect is open to question. The maps showing vegetation and tribal divisions are very much simplified, and this reviewer can see little value either in the index map in an atlas of this sort, or in those showing the distribution of medical and postal facilities, information which might more usefully have been included in the gazetteer at the end. With the space thus saved it might have been possible to have had separate temperature maps instead of showing temperature and rainfall information on the same maps. The various climatic graphs are useful, but unfortunately the rainfall map was out of date before it appeared owing to the publication last year by the Sierra Leone Meteorological Department of recently compiled statistics.

After a careful study of this atlas the reviewer is still not certain what the object of it is. Is it for use in schools, as some maps seem to suggest? Then the introductory maps are far from adequate, while the maps of soils, minerals and geology are unsuitable as they stand: some of the information at the end is likewise out of place in a school atlas (*e.g.* geodetic data). Is it meant as an authoritative compilation of maps of Sierra Leone? Then maps such as the introductory ones, and those showing medical and postal facilities are out of place, while some such as those showing vegetation and tribal distributions are far from adequate. Attention might on these counts be drawn to the competent vegetation map published as part of a supplement to the Soil Conservation Report (Freetown, 1951), and to the discriminating work of the late J. Richard Mollard on tribal distributions in West Africa, the results of which have already been in part published by I.F.A.N.

It is almost inevitable that in such a work as this a few slips appear. Thus the upper course of the Niger is here shown as a motorable road (pp. 7 and 9), while the important groundnut port of Kaolack is wrongly placed (p. 4), being marked more nearly where Guinguineo stands.

Despite all this, however, the atlas is indispensable to those making a serious study of the geography of Sierra Leone, and one may perhaps hope that a future edition, possibly more cheaply priced, may offer an opportunity for a revision of certain points, when an excellent piece of work could easily follow.

H. R. J.

AUSTRALASIA

PAPUANS AND PYGMIES. By ALFRED A. VOGEL. *London: Arthur Barker, Ltd.*, 1953. $8\frac{1}{4} \times 5\frac{1}{2}$ *inches; 159 pages; maps and photographs.* 16*s*

This is a popular account, translated from Swedish, of a small expedition sent at the end of 1950 to the southern flank of the Bismarck Range in North-Eastern New Guinea in search of white birds of paradise and black pygmies. The journey was planned and financed by Sir Edward Hallstrom, a wealthy Swedish-Australian business man interested in ornithology but determined to explore without scientists lest they rob him of the glory of his results (p. 14).

His party, consisting of himself, a photographer and Captain Vogel, who was a retired Swedish military officer, went by air as far as Nondugl, an experimental farm maintained by Sir Edward in the Wahgi Valley within a week's march of the Bismarck Range. To Captain Ned Blood, the Australian manager of the experimental farm, fell the real work of getting the party to the pygmy country, for Hallstrom became ill before they left Nondugl and had to be flown back to Sydney. Captain Blood led a column consisting of about a hundred Papuan carriers, Vogel and the photographer, and Mrs. Blood and her small daughter, through forests and swamps and over high passes to a place where the pygmies had thrown a liana bridge across the Jimmi River, and then led them back to Nondugl whence Vogel had to be sent to hospital. They were about five weeks in the field. No white birds of paradise were found, but the collections of Swedish museums are now the richer by rats, beetles and prehistoric stone artifacts collected by Vogel. Blood collected butterflies for Australian museums. With qualified observers results of great value might have been obtained. The performance, however, can rank only as arduous though important reconnaissance. Vogel writes as if "we were the first who ever burst into that silent sea," but the assurance with which Blood allowed his little girl to be carried in a litter right to the foot of the Bismarck Range expresses the pacification of eastern New Guinea by a government determined to protect the natives from "irresponsible whites and the degenerates of culture" (p. 46). Fifteen years ago the journey would hardly have been possible to such a party. The book is superficial and the narrative generalized, but it is sensitive and lively. The translator and the photographer deserve high praise. M. A.

TRUE PATRIOTS ALL, or News from early Australia as told in a collection of broadsides. Edited by Geoffrey C. Ingleton. *London: Angus and Robertson*, 1953. 11×9 *inches;* 280 *pages; illustrations.* 42*s*

This collection of reproductions of old broadsides relating to Australia, many of them in facsimile, is a typographical curiosity and represents a source of information of some importance to the social historian. But it is such a brutal record of the darker aspects of transportation and emigration that one wonders why it is offered to the public for general reading and entertainment. The title-page proclaims murders and executions, piracies and mutinies, and awful shipwrecks. The illustrations on pages 230–2 (of daily life in an emigrant ship) show what real treasures may lie hidden in the sewers of history. M. A.

POLAR

THE ANTARCTIC TODAY. (Compiled by the New Zealand Antarctic Society, editor F. A. Simpson.) *Wellington, N.Z.: A. H. and A. W. Reed and N.Z. Antarctic Society*, 1952. 9¼×7 *inches;* 389 *pages; maps, illustrations and diagrams.* 47*s* 6*d*

Future historians will doubtless conclude that the exploration and development of Antarctica took an unconscionably long time. As early as the sixteenth century geographers believed that such a continent existed, but no navigator sighted the mainland until the nineteenth century. The first known landing was made only sixty years ago, so that geographical exploration really belongs to the twentieth century. It is remarkable that although W. S. Bruce established a weather station in the South Orkneys which has been manned by Argentine observers for nearly fifty years, the desirability of similar stations on the continent itself was not generally recognized until 1943, when the Falkland Islands Dependencies Survey was established. Since that time scientific

services have been formed by other countries interested in Antarctica. The New Zealand Antarctic Society has now produced an impressive volume to mark the emergence of this new policy. Its theme is "the Antarctic as viewed by the three inhabited land masses of the southern Indian and Pacific Oceans."

It would be surprising if this compilation, with a score of contributors, did not contain many challenging opinions. One in particular is worth quoting, as it represents the new attitude:

"A great deal of the scientific research that can usefully be undertaken on a short-term basis has already been carried out, and with regard to the physical sciences, which are assuming greater prominence to-day, it has become apparent that only expeditions capable of making *continuous* observations over a long period can achieve really valuable scientific results. Because this involves permanent research stations, trained personnel and intricate and expensive scientific apparatus, such expeditions are now beyond the means of private individuals or commercial interests and can be effectively undertaken only on a national basis."

It is true that the expense of future work will be borne by public rather than by private funds, but the countries of the southern hemisphere should not overlook the usefulness of short-term expeditions such as the Norwegian–British–Swedish Antarctic Expedition and, on a smaller scale, the South Georgia Survey, to investigate particular problems which might not, perhaps, be resolved so readily by the staff of a scientific station.

Those interested in the resources of Antarctica will find much useful information. It has been estimated that only about 0·2 per cent. of the total land area of 5,000,000 square miles is geologically known and Rhodes W. Fairbridge provides an excellent summary of present knowledge. It is clear from his conclusions that a survey of the mineral resources is urgently required, for conflicting territorial claims will hardly be settled while mineral wealth remains in doubt.

The greatest mainspring of human activity in the Antarctic so far has been the exploitation of marine resources. The papers by C. A. Fleming on the physical oceanography, and by R. K. Dell on the marine biology of the Southern Ocean form a useful background particularly for W. H. Dawbin's account of antarctic whales and whaling, and of the growth of international cooperation to safeguard this industry. The achievements of the Discovery Investigations in biological research, and of Norwegian work in maintaining stocks of whales, are given due recognition. It is regrettable however that neither Dell nor Dawbin mentions the growing importance of Japanese studies. Japanese interest in antarctic whaling is comparatively recent but, with the absorption of the Discovery Investigations into the National Institute of Oceanography, leadership in this field may pass to the Whales Research Institute in Tokyo.

Much attention has been given to the development of transarctic aviation. Judging by what has been achieved in the far north there is no reason why long-range aircraft should not fly across Antarctica from Australia and New Zealand to South Africa and South America, once weather stations and emergency airstrips have been established. The possibilities have received little attention, largely because the population of the southern is so much smaller than that of the northern hemisphere, but the construction of a French scientific station on Îles de Kerguelen, and plans to build an airstrip there, suggest that the likelihood of transantarctic aviation is not being ignored. It is disappointing that S. A. C. Campbell, describing problems of air navigation in these regions, confines his remarks solely to short-distance reconnaissance work. It is also disappointing that there is no consideration of the relative merits of various

forms of ground transport. Mechanical vehicles, if necessary with air support, have proved superior to dog-sledges under many conditions, and the opportunity should have been taken to discuss their relative merits.

The chapter dealing with recent field work, compiled by the editorial committee seems unsatisfactory because it lacks perspective. What useful purpose does it serve to know for example that an expedition's aircraft "flew a total of 346 hours, made 86 landings in the field and included 250,000 square miles of new land in a total of 700,000 square miles covered by 14,000 aerial photographs"? Some recent visitors to Antarctica have shown a regrettable addiction to such statements, at which the imagination boggles and perspective fades into insignificance. A few minor points deserve criticism. Most of the chapters have useful lists of references, but those by R. A. Falla, describing antarctic birds, and I. L. Thomson, concerning auroral studies, have not. The first navigator to sight the mainland was not John Biscoe in 1831, but Edward Bransfield in 1820. The unfortunate term "iced-up" has crept into the caption of a photograph showing the *John Biscoe* beset. The Society has not conformed to the practice of giving place-names in the local official form, or at least of giving this form in brackets. Lastly, the book nowhere deals with the anomalous position of Antarctica in international law. Specialists will find more to criticize in their particular fields, yet it would be ungenerous to over-emphasize the faults of such a fine book. 'The Antarctic today' is an authoritative and comprehensive review and is worthy of praise and study. J. D. M. B

PHYSICAL GEOGRAPHY

THE EARTH AND ITS MYSTERIES. By G. W. Tyrrell. *London: G. Bell and Sons;* $7\frac{1}{2} \times 5$ *inches;* xii+278 *pages; illustrations and diagrams.* 16*s*

THE OCEAN RIVER. By Henry Chapin and F. G. Walton Smith. *London: Gollancz,* 1953. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* x+325 *pages; maps and diagrams* 16*s*

Dr. Tyrrell's book is an excellent comprehensive introduction to geology; it is clear and readable, and will be valuable both to the non-specialist and to the student. The writing is at once vivid and sober; Dr. Tyrrell on occasion describes his own first-hand observations; he quotes the most modern records and theories; and his discussion of controversial problems is lucid and well balanced. The book is liberally illustrated with photographs as well as line-drawings, yet the price is moderate, and it is a volume thoroughly to be recommended.

'The Ocean River' is a history of the North Atlantic, of the colonization of North America, and of the rise of the United States as a nation. The book begins with the origin of the earth and ends with a discussion of the political and economic relations of the modern Atlantic communities. The authors use the phrase "ocean river" sometimes for the North Atlantic as a whole and sometimes for its system of currents. This confusion of thought is reflected in the unreliable early section on the evolution of the earth; there follows a dogmatic description of the entire course of organic evolution; and the reader has been wrought into a suspicious and sceptical mood by the time that he reaches the chapters on the history of exploration, navigation, oceanographic investigation, fisheries and colonization, in which the authors appear to be on much surer ground. This, the main, part of the book is a stimulating and fascinating attempt at synthesis, and it is a pity that the volume as a whole is spoilt by an over-ambitiousness which contrasts oddly with Dr. Tyrrell's scientific caution. The two books, emanating from Glasgow and Miami

respectively, illustrate in themselves certain aspects of the wide range of culture which has arisen on the shores of the ocean river. M. A. A.

STRUCTURAL GEOLOGY (Geology series). By MARLAND P. BILLINGS. *London: Sir Isaac Pitman & Sons*, 1952. 9×6 *inches;* xi+473 *pages; maps, diagrams and illustrations.* 50*s*

The fact that this book has reached its eighth printing is good evidence of its usefulness. It is a straightforward account of the principles, method and technique of structural geology. It is also emphatically a text-book. Much that it contains is elementary—descriptions of folds, faults and joints. On the other hand it also gives useful summaries of salt domes, the tectonics of granite, and geophysical methods as they are applied to structural geology. Throughout it is illustrated with clearly drawn and pertinent diagrams, sections and maps. All these help the student or general reader a great deal. The photographs, however, are not very satisfactory.

Many of the chapters contain fuller accounts than are usually found in similar works on such subjects as secondary foliation and lineation, structural petrology, and fabric symmetry. At the end of the volume there are several examples of geological maps and a discussion of the solutions of various problems that arise in mapping. In a sense this part is really a separate book, but nevertheless relevant to the main theme.

The book is one to consult and use as a text-book. The great number of facts given, and the numerous terms used, make it extremely valuable, but at the same time somewhat unreadable except as a book of reference. The student of geomorphology and of kindred sciences will find it a most useful compendium—already almost condensed into note form! J. A. S.

ECONOMIC GEOGRAPHY

THE GEOGRAPHY OF TOWNS. By A. E. SMAILES. (Hutchinson's University Library). *London: Hutchinson House*, 1953. 7½×4½ *inches;* 166 *pages; maps.* 8*s* 6*d*

To those familiar with the state of urban geography twenty or thirty years ago Mr. Smailes' book will come not only as a well-rounded consideration of the subject but also as a gauge of its rapid development. From the intensive study of particular cities in isolation, geographers have moved to the general study of the distributional manifestations of urbanism in society. Writing a small volume in a planned series, Mr. Smailes has had to work within the limits of about 150 pages of text, and has confined his references mainly to works available in English. His book is therefore essentially a study of urbanism in Great Britain. It compares, nevertheless, very favourably with such recent work as Chabot's 'Les Villes' (1948) and George's 'La Ville' (1952).

Smailes has traced the course of urbanism, as expressed through the development of cities, from very early times; he has analysed the more important conditions of emplacement of cities and towns; has displayed the commoner features of their morphology by reference to numerous examples in various parts of the world; and has demonstrated the existence of a pattern of "urban fields" in Great Britain which ought to claim the attention of all rural and urban planning authorities. "The highly developed urban integration of life," he says, "makes the urban field the real unit of modern community structure, rather than the town, the village, or the rural district"; and finally, "Town and country are indivisible, both geographically and socially, and the establishment of the fundamental facts concerning their inter-relations is a condition

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precedent of success in the social and economic planning to which we are committed."

There are a few blemishes on the book which might be removed from a new edition. There is confusion between text and index over the name of S. (or H. S.) Thurston, and there is no precise reference to where his work was published; and the site of the core of Sydney, N.S.W., was determined not by the features mentioned on p. 48, but by the existence of a perennial stream of fresh water (which now flows underground) at Sydney Cove. Lack of balance, not of the book but of the subject, is indicated by the relative neglect of the economics of urbanism. Urban fields, as presented here, pertain to towns; but cities of metropolitan status cannot be treated as towns, and the relations between their hinterland trade and their extended trade are of the greatest importance. More necessary still to the healthy existence of towns and cities, are fresh and adequate supply of perishable commodities, and efficient sanitation. The reticulations for the supply of water, gas and electricity, and for the disposal of sewage, are as important as the roads and railways, and await proper geographical as opposed to engineering study. That study will, I believe, confirm the validity of Mr Smailes' own contribution to urban geography, the conception of urban fields. M. A.

CARTOGRAPHY

THE GEOGRAPHICAL INTERPRETATION OF TOPOGRAPHICAL MAPS. By ALICE GARNETT. 3rd Edition. *London: George Harrap and Co. Ltd.*, 1953. $7\frac{1}{2} \times 5$ *inches;* 309 *pages; frontispiece and maps in text, and* 25 *maps in accompanying folder.* 10*s* 6*d*

GEOGRAPHY FROM THE AIR. By F. WALKER. *London: Methuen and Co. Ltd.*, 1953. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 111 *pages; diagrams and air photos.* 30*s*

ELEMENTS OF CARTOGRAPHY. By ARTHUR H. ROBINSON. *London: Chapman and Hall*, 1953. $9\frac{1}{2} \times 7\frac{1}{2}$ *inches;* 254 *pages; maps and diagrams.* 56*s*

'The geographical interpretation of topographical maps' by Alice Garnett, Senior Lecturer in the Department of Geography at the University of Sheffield, is the third edition of a text-book already known to a wide public as a model of its kind. Of the text of Dr. Garnett's book, it is sufficient to note here that she is always conscious that the mind must ever "read and not spell the map" and that "facts are not only read *from* it but *into* it." The new edition is accompanied by a revised series of maps arranged as loose sheets and issued in a separate envelope. Maps can thus be consulted freely. They are widely selected from British, American, Norwegian and Swiss sources and are for the most part reproductions from the originals. Unfortunately only a limited range of colours has been used in the reproduction, no doubt because of the problem of cost, and this has meant that some of the clarity and beauty of the originals has been lost—particularly is this true of the Ordnance Survey, One-inch (New Popular Edition).

Dr. Garnett remarks "that a sample of the world setting of human activities cannot be transported for study into the geographical laboratory. When analysis in the field is not possible, study depends primarily on the map [. . .]." But Mr. F. Walker, Lecturer in Geography at the University of Bristol, thinks differently. In 'Geography from the air,' Mr. Walker does take "samples of the world setting" into the laboratory and there analyses them at leisure. Air photographs afford the samples and Mr. Walker sets out to show how they may be used to aid all manner of geographical studies. His method is to examine nearly a hundred air photographs and to offer an interpretation of

each in terms of the information they yield on geological distributions, erosional processes, relief and soils, coastlines and settlements. With commendable restraint Mr. Walker has confined his collection to the British Isles and it includes many fine plates. It is unfortunate, however, that there are so few stereoscopic examples. Nor does Mr. Walker include any oblique air photographs and in an introductory book of this type their comparative value would have been considerable.

In his treatment of his subject Mr. Walker manages to impart something of his own enthusiasm for air photographs. On this account, even if he is tempted to detect much from the air that would better be ascertained on the ground or from a map, he is readily forgiven. His book will do much to popularize air photographs and will lend emphasis to the view that no regional treatment of landscape can be complete without reference to them.

'Elements of cartography' by Arthur H. Robinson, Professor of Geography in the University of Wisconsin, is designed as a text-book for the training of cartographers. Professor Robinson was formerly chief of the Map Division in the Office of Strategic Services of the United States and his experience as a practising cartographer stands him in good stead in the task he has undertaken. In his book Professor Robinson contends that "the act of drafting a map is no more cartography than typing is authorship." In his opinion, intellectual and visual skills are more important to the cartographer than an ability to wield a mapping pen. But, he points out, a knowledge of drafting techniques is a desirable asset to any cartographer even if only to prepare him "better to direct a more skilful draftsman."

After the opening chapter in which Professor Robinson attempts to justify his definition of cartography there follow three down-to-earth chapters on co-ordinates and map projections and their construction. The principles governing the selection and employment of different projections is rightly emphasized and in this connection a useful series of sketch-maps is included to show amounts of angular deformation and areal exaggeration of various projections. The four chapters which follow, on drafting materials, compilation of the base-map, map design and lettering respectively, constitute the kernel of the book. All geographers who have had to prepare maps for publication will acknowledge their value and all who are about to do so would well be advised to seek guidance from them. Of incidental interest are descriptions of American drawing equipment which differ in detail from that in use in this country. In the chapter on lettering for example mechanical scribers and lettering instruments are mentioned which are totally unfamiliar to English cartographers.

The two final chapters are concerned with special types of maps, one chapter being devoted to distribution maps and the other to representation of relief and landforms. That on distribution maps is too condensed for its contents to be readily appreciated, nor are the illustrations convincing, particularly when use is made of hypothetical distributions. This chapter could well be extended and clarified in a future edition. In the last chapter on relief, Professor Robinson summarizes the orthodox methods and treats also of those of the pictorial school, for example, the devices of R. E. Harrison and E. Raisz. Disappointingly little reference however is made to methods of relief representation which have as their aim the depiction of landforms in terms of their genesis and evolution. H. R. W.

WELTATLAS: die Staaten der Erde und ihre Wirtschaft. [Ed. by Prof. Edgar Lehrmann with the assistance of Prof. Heinz Sanke.] *Leipzig: VEB Bibliographisches Institut*, 1952. 9¾×13 *inches; 97 plates; 63 pages; index.*

This is an entirely new atlas which has several interesting features. Each economic map faces a corresponding location map on the same scale, so that the former is kept free of much detail. The relevant economic information is shown by a uniform system of colouring and conventional signs. The basis of the economic maps is land utilization, shown by solid colour. Twelve categories are distinguished, from first class arable to steppe and desert, with superimposed symbols in colour to indicate the predominant crops. Mineral resources are shown by signs and letters mostly in black, and industries similarly in red or blue. By this scheme much information can be conveyed in little space. The colours harmonize well and no one feature is over-emphasized.

Germany, as might be expected, is treated in greatest detail; in addition to general maps, the country is covered in five plates at a scale of 1/1·4M. Other European countries are on scales varying from 1/1·65M. to 1/7M. Outside Europe and Asia, where the information is of necessity often very generalized, the scales are much smaller. No information is given as to the sources on which the maps are based. In an economic atlas of this type, it might have been expected that transport and communication routes would have been delineated a little more clearly. Names in countries using the Latin alphabet are given in local official forms; elsewhere they are transcribed into German forms. On the map of the British Isles, it would be possible to criticize the selection of the towns of lesser importance. "Hasholm" appears to be intended for Heysham.

This should prove a very useful reference atlas for students of economic geography. G. R. C.

THE MAPMAKERS' ART: Essays on the history of maps. By EDWARD LYNAM, with a Foreword by Sir Thomas Kendrick. *London: The Batchworth Press*, 1953. 8×10 *inches; 140 pages; illustrations.* 21*s*

It is a great pleasure to have these scholarly essays collected into one well-illustrated volume. Dr. Lynam's intimate knowledge of the great collection of maps in the British Museum which were his special care for nearly twenty years, permeates each and every essay; this book will allow our generation and posterity to enjoy and to profit by the fruits of his learning.

The first essay—"The character of England in maps"—is a brilliant example of the way in which a collection of maps can be used to illustrate the changing geography of England throughout the centuries. The second one—"Period ornament, writing and symbols on maps"—is a technical appreciation of the cartographer's art and gives a delightful introduction to the problems of map design. The next two essays—"English maps of the sixteenth century" and "An atlas of England and Wales"—discuss the work of the earliest surveyors of the English counties. The work of Saxton, which with Thomas Leckford's support resulted in the production of the first atlas of England and Wales, receives most attention.

The fifth essay treats of the problems of map engraving and atlas publication in the sixteenth century and emphasizes the close links between the English surveyors and the Flemish engravers. The last two essays—"William Haek and the South Sea buccaneers" and "Early days in Bermuda and the Bahamas"—illustrate the influence colonial interests had on the art of cartography, and also the contribution that the study of contemporary maps makes to the understanding of colonial history.

The illustrations—there are 53 figures—are admirable photographic reproductions in black and white, and they do much to convey the charm of the original maps from which they are taken. The illustrations have been chosen and the essays edited by Mr. Skelton, who has also added an occasional footnote.

J. B. M.

METEOROLOGY

THE RESTLESS ATMOSPHERE. By F. K. HARE. (Hutchinson's University Library.) *London: Hutchinson House*, 1953. 7½×5 *inches; 192 pages; charts and diagrams.* 8*s* 6*d*

The title well reflects the contents of this little book which may be described as dynamical climatology, and it serves a most useful link between ordinary statistical climatology and pure meteorology. The author, who is Professor of Geography at McGill University, first treats of general principles and then goes on to explain the major regional climates of the globe in terms of modern frontal and air mass analysis. He very rightly insists that stereotyped concepts like Trades, Monsoons and Westerlies should be regarded not as fixed, readily identifiable winds, but as systems of pattern flows subject to all kinds of transformations from day to day yet providing a standard of references for these very changes. A distinction is drawn between absolute, conditional and potential atmospheric instability so significant in thunderstorm problems, with a concise lucidity hopeless to find amid all the cluttering detail of advanced works; but one would take exception to the author's disregard of relative humidity and his caricature thereof as the "meteorological equivalent of absolute humbug." It is true, as he says, that relative humidity values must be read intelligently with due regard to the level of temparature to which they refer, since a relative humidity of, say, 60 per cent. in summer when the absolute humidity is high has a very different physiological import from the same value in winter. Yet it is precisely at the higher temperatures that relative humidity is such an excellent index of the drying capacity of the air. It should be noted that Griffith Taylor's climographs for damp heat and cold in different parts of the world are suitably assessed in terms of wet-bulb temperature and relative humidity.

The winter climate of the Po Valley which forms a cold pool of Alpine drainage subject moreover to protracted precipitations from the slow-moving lee-side depressions is considered one of the most unpleasant in Europe; and readers with preconceived notions about the climates of England and Italy may be disturbed to read that Milan's winter weather with twenty-four days of fog in January is more unpleasant than Manchester's. To the extent that there may be more variety in the Lancashire weather to set off its most disagreeable phases the comparison is probably fair, though it should be remembered that Lombardy experiences a brief steep seasonal trough of continental cold rapidly alleviated during February.

L. C. W. B.

WEATHER INFERENCE FOR BEGINNERS: made clear in a series of actual examples. By D. J. HOLLAND. *Cambridge: Univ. Press*, 1953. 10×7 *inches; 196 pages; charts, diagrams and tables.* 30*s*

The author, now an official forecaster, kept when a schoolboy an elaborately coded weather diary in the autumn of 1936 mostly in the southern suburbs of London. This diary he uses as a kind of text—"the series of actual examples"—for introducing his readers to the fundamental principles of meteorology as occasion arises. In this way they learn about radiation, winds and pressure gradients, fronts and air-masses together with equivalent and potential temperature, entropy and tephigrams—all included in the modern forecaster's

technique. Inevitably therefore readers come in for a fair measure of mathematics, mostly simplified, but it would seem that too much space is alloted to the calculation of such a purely physical problem as the amount of energy in a cyclone.

At the bottom of page 160 an obscure paragraph needs revision. It is implied that whereas on a fine frosty day in December the sun alone is too low in England to raise the temperature much above the freezing point on a similar day in January the sun might raise it to nearly 50° F. But the increase in the strength of the sun from December to January which only becomes noticeable towards the end of the latter month is too small for such a large difference in relative heating power.

Designed to help the general reader as well as the forecaster inside the Meteorological Office itself, this book certainly succeeds in illustrating the immense difficulty in predicting the rapid changes of a complex three-dimensional fluid like the atmosphere wherein even a minor trough or wave in the upper air hardly detectable on the surface charts can completely upset the local forecast. It should also bring home to the geographer how intimately bound up with the differentiation of the Earth's surface is the genesis and transport of daily weather. On the other hand it is a work a little odd in conception with several rather clumsy phrases and fatuous remarks, and the high price of the volume due presumably to the large print and coloured charts will only repel many an impecunious beginner whom it was meant to attract. L. C. W. B.

GENERAL

SKYE AND THE INNER HEBRIDES. By ALASDAIR ALPIN MACGREGOR. *London: Robert Hale, Ltd.*, 1953. $8\frac{3}{4} \times 5\frac{3}{4}$ *inches;* xi+328 *pages; map and illustrations.* 18*s*

THE WESSEX HEATHLAND. By RALPH WIGHTMAN. *London: Robert Hale, Ltd.*, 1953. $8\frac{3}{4} \times 5\frac{3}{4}$ *inches;* viii+191 *pages; map and illustrations.* 18*s*

TRAVELS WITH A TENT IN WESTERN EUROPE. By R. M. LOCKLEY. *London: Odhams Press, Ltd.*, 1953. $8\frac{1}{2} \times 5\frac{3}{8}$ *inches;* 240 *pages; end-papers map and illustrations.* 15*s*

SPRING IN SPAIN. By MACKINLEY HELM. *London: Victor Gollancz Ltd.*, 1953. $8\frac{3}{4} \times 5\frac{3}{4}$ *inches;* viii+315 pages*; illustrations.* 18*s*

The volume in the County Books series dealing with the Inner Hebrides treats fully all the islands nearer the Scottish mainland, paying special attention to the lesser known ones. Lavishly illustrated by the author's own photographs, the book is packed with information. The increasingly depopulated islands that inspired Mendelssohn are here considered from many aspects. Tales of fierce feuds between ancient clans and of faeries, of the carefully kept Faery Flag of the MacLeods of Dunvegan and of the solitary Brownie of Cara for instance, mingle with descriptions of rock formations, of Christianity and of farming in the islands, and of views that stir the imagination among haunts of bird-watchers and wild flowers. The islanders' character, the old even fanatical attachments to native soil, and the rebellion of the young against limited horizons are all described. One could wish the map were easier to handle.

Ralph Wightman's contribution to the Regional Books series, also well illustrated, is a rather more systematic work. The 'Wessex Heathland', or Yetene Heath, is the geological and ecological entity of mainly gravel and clay soils—a rough geological map would not have been wasted here—that stretches south-eastwards from Stinsford near Dorchester, over Wool Heath, Purbeck Heath

and the New Forest, to near Southampton. Part of the appeal of the Dorset agriculturalist's book lies in his evoking the atmosphere of Hardy's Egdon, in his expressing the country-lover's resentment of the army's use even of infertile land, his maybe more justified revolt against the destroyers of Bindon and Beaulieu Abbeys, and his joy at the glorious rhododendron gardens of Exbury.

R. M. Lockley, well known as naturalist and more especially as ornithologist, has written a pleasing and very readable account of a trip through eight countries of Western Europe. He travelled with a friend and camped, or else went alone in a small van, always avoiding large towns, from Brittany down through the Dordogne to the Rhône delta, up through Switzerland and Germany to Scandinavia, and then back along the northern seaboard to the Channel. Among the highlights, for this reader, were the Virgilian thoughts on farmers' happiness of an ex-prisoner farmer of Poitou, the long-awaited encounter with flamingoes in the Camargue, the visit to Fabre's birthplace, and home at Sérignan, and the sea-swallows' nests on the Frisian island of Scharhörn.

A much more sophisticated book, 'Spring in Spain,' is the work of an American who came to his love of things Spanish through first knowing Mexico. Dr. Helm is specially responsive to the arts, to painting, architecture and literature in particular. His three months in the sunny though "stern and melancholy" country were spent largely in southern and central cities that are among Europe's finest treasurehouses of art and history. This slightly uneven book holds many passages of sheer delight for every lover of Spain and of good writing, from the search for traces of Columbus to the translations from Lorca. Politics, food and drink come into the picture with descriptions like that of the carvings of Spanish kings on the walls of the Plaza Mayor in Salamanca where the "small generalissimo" of our own time displaces a former occupant.

L. R. W.

GEOGRAPHY IN THE PRIMARY SCHOOL: second edition revised. *Published by the Geogr. Association*, 1953. 10×6 *inches;* 36 *pages.* 2*s*

This is the work of a formidable collection of practical teachers in Primary Schools and Training Colleges and contains much practical advice and guidance for those engaged in teaching the subject in Primary Schools. The writers must be presumed to know their subject which they treat in such minute detail of precept and illustration.

Yet much of the instruction recommended seems to be a laborious pointing out of facts which must be familiar even to very young children. The cardinal points, for instance, must surely be known as soon as the child learns the words "north," "south," "east" and "west," which it does very soon; and the position of the local sweet-shop does not need to be taught to children after they are old enough to find their way to it. Most of the illustrations of urban geography are unreal.

The truth is that local geography, from its mass of complex detail, is a difficult subject and beyond the comprehension of children in the first years at the Primary School. The principle of starting from the local area and working outwards sounds logical and tidy, but in reality it has great drawbacks. Besides its difficulty, it is apt to be dull and in fact does not help comprehension of foreign lands. No English wood can give more than a misleading idea of tropical forests. Other countries differ from our own in scenery, climate and vegetation and induce different outlooks in their inhabitants. Furthermore, there is a grave risk of producing narrow minds and home-centred ideas by this method of concentrating on the homeland in early school years. Far better it is to stimulate the childrens' imagination and appeal to their love of adventure

and novelty by introducing them to picturesque peoples, scenery and events in foreign lands, leaving the homeland to be studied at a later date when the older pupils can grasp the complexity of detail involved.

It is a pity that the pamphlet uses so much jargon. "Awareness" (=knowledge) occurs again and again, but is not to be found in the Shorter Oxford Dictionary with the meaning attributed to it here. "Mental life" (=mind), "relevant" (=associated with), "skills," "techniques" all seem strange to the ordinary reader not acquainted with this esoteric language. E. D. L.

THE TEACHING OF GEOGRAPHY IN SECONDARY SCHOOLS: third edition revised. *Issued by the Incorporated Association of Assistant Masters in Secondary Schools*, 1952. $7\frac{1}{2} \times 4\frac{1}{2}$ *inches;* xxiv+512 *pages; maps, illustrations, diagrams.* 17*s* 6*d*

When the first edition of this work was published in 1935, it was generally welcomed by teachers of geography. The present edition has been revised by a strong committee and covers the whole range of teaching of the subject by masters in State secondary schools. Certainly no teacher of geography should be without a copy of the book. Comprehensive without being dogmatic, it contains a pool of ideas contributed by a wide range of experienced teachers, and from this the individual teacher may select those that appeal to him or suit his particular circumstances. Not all the contents will meet with general acceptance however. Culture as defined by a foreign anthropologist to include every commonplace aspect of life in a community may be technically correct anthropology, but is not generally understood in that sense. It is possible too that in the early stages of study tales and descriptions of other countries and peoples may achieve more by awakening interest and stirring the imagination than can the apparently more logical attention to the local surroundings. Incidentally, the reference to the *Times* weather chart on page 257 seems to imply that the chart is a record of observations. It is, in fact, a forecast of conditions based not on "the readings of the previous evening," but on those of the previous midday. It is a pity that an important work should deliberately confine its interest to one group of secondary schools. E. D. L.

OUR WORLD FROM THE AIR. By E. A. GUTKIND. Published under the auspices of the British Institute of Sociology, with a foreword by G. P. Gooch and an introduction by Professor E. G. R. Taylor. *London: Chatto and Windus*, 1952. 12×11 *inches;* 400 *plates; maps and diagrams.* 63*s*

Dr. Gutkind has brought together four hundred informative and stimulating plates mainly from oblique air photographs to illustrate the relations between man and his environment. He ranges widely in space, and also in time, as far as its traces are still visible in the landscape. He has arranged them to illustrate his views on sociological trends—for "the continuous transformation within the mind of man is visibly expressed in his changing environment." The sectional headings express his point of view on the march of events: Fear and security; Confidence and adjustment; Aggressiveness and disintegration; Responsibility and unification.

The photographs demonstrate clearly the varied conditions in which the world is living and working, and will bring before the student scenes of which he will have read but perhaps never clearly visualized. He will also find much to ponder over, and to interpret. G. R. C.

SEARCH FOR THE SPINY BABBLER: Bird Hunting in Nepal. By DILLON RIPLEY. *London: Victor Gollancz Ltd.*, 1953. 8×5 *inches;* xi+301 *pages; end paper maps.* 14*s*

JOURNEY INTO WONDER. By N. J. BERRILL, F.R.S. *London: Victor Gollancz Ltd.*, 1953. 7¾×5 *inches;* 320 *pages.* 13*s* 6*d*

Dillon Ripley's book is an entertaining account of the author's visit to Nepal in 1948, undertaken primarily for the purpose of collecting birds. This region is of especial interest to ornithologists owing to the work of Brian Hodgson, Resident in Nepal from 1821 to 1843, who recorded no fewer than 563 species of birds, all from specimens brought to him at Katmandu by Nepalese collectors. These species now require to be rechecked for many of his specimens have disappeared and others are worn and discoloured.

The title of the book is derived from the name of one of these birds, rediscovered after an interval of one hundred and six years. The author was fortunate in being allowed to travel more or less freely in Nepal and his descriptions of travel in a little known country should interest geographers.

The book by Dr. N. J. Berrill, F.R.S., Professor of Zoology at McGill University, is an outstanding example of the way in which the records of early voyages can be amplified by a trained naturalist. Starting with the first voyage of Columbus, new light is thrown upon the site of landing and the route taken, by a consideration of the various animals encountered during the voyage, which, ranging from phosphorescent worms to birds and mammals, together with the magnetic variation of the compass, indicates a somewhat different route from that generally accepted. There is a long chapter on some of the travels of William Dampier, surely one of the most extraordinary adventurers of his time —at first little more than a pirate with an interest in natural history who later became a friend of the Secretary of State for Ireland, the President of the Royal Society, and Charles Montagu, Earl of Halifax. He was also a favourite of Dean Swift, and John Evelyn wrote of a dinner with Mr. Pepys where he met this famous "buccaneer".

An account of the journeys of Hawkins, Dampier and others leading on to the travels of Cook and the Forsters, and the wonders of Polynesia, ends in a voyage round the world in Antarctic latitudes about the time of the American revolution. The later part of the book starts with the journeys of von Humboldt, followed a generation later by Charles Darwin. There is a brief reference to Antarctic exploration and speculation on the nature and origin of penguins and an account of the journey to find the eggs of the Emperor Penguin.

Every page of this fascinating book brings out the romance of exploration combined with natural history and fully justifies the title 'Journey into Wonder'.

E. H.

THE SOCIETY'S NEWS

BRITISH MOUNT EVEREST EXPEDITION 1953

The British Mount Everest Expedition sponsored by the Himalayan Committee of the Society and the Alpine Club returned to England in July, and an account of the successful ascent of the mountain, so long in the foreground of the Society's activities, appears in this *Journal*. A series of lectures by members of the Expedition, illustrated by coloured slides, was immediately planned under the auspices of the Himalayan Committee and the first of these took place at the Royal Festival Hall, London on September 14, before an audience of Fellows of the Royal Geographical Society and members of the Alpine Club. Her Majesty the Queen, Patron of the Society, and His Royal Highness the Duke of Edinburgh were graciously pleased to be present at an afternoon meeting at the Royal Festival Hall on November 2, and also at the first showing of the film "The Conquest of Everest" at the Warner Theatre on October 21. At the Festival Hall, Her Majesty The Queen and His Royal Highness the Duke of Edinburgh were greeted by Her Royal Highness the Duchess of Kent, Honorary President of the Society. The lecture was also attended by Her Majesty Queen Elizabeth the Queen Mother and by Her Royal Highness the Duchess of Gloucester.

The film, a Countryman Film production presented by Group 3, was photographed by Mr. Tom Stobart (photographer on the Norwegian–British–Swedish Antarctic Expedition 1949–53) who accompanied the climbers as far as the Advance Base in the West Cwm; further photographs were taken on the higher ground to within sight of the South Summit by Mr. George Lowe.

In addition to public lectures in London, Edinburgh, Belfast, Cardiff and cities and country towns throughout the British Isles, members of the Expedition are speaking widely abroad. Paris, Brussels and the Scandinavian capitals have been visited, a tour of America and Canada is planned during the early part of 1954, and Sir Edmund Hillary and Mr George Lowe have already addressed audiences in New Zealand, Hong Kong and Singapore. The official account of the Expedition has been written by Sir John Hunt and published by Hodder and Stoughton with the title of "The Ascent of Everest." The net proceeds from all these lectures, from the film, and from the official books on the expedition, will go to a Trust Fund to further exploration and research in mountain regions, administered by representatives of the Society, the Alpine Club and the Himalayan Club.

APPLICATIONS FOR GRANTS FOR EXPLORATION AND RESEARCH, 1953

Applications for grants must reach the Director and Secretary not later than 1 March 1954: it is only in very exceptional circumstances that late applications can be considered. Applications should state (*a*) their scheme of research or scientific programme: (*b*) the names, number and qualifications of members of the party: (*c*) length of time to be spent in the field; (*d*) total estimated cost; (*e*) names of other institutions to which they have applied for help; (*f*) the amount of the grant, and any other assistance, that they request. Applications should be accompanied by two letters from qualified institutions or individuals supporting the proposed expedition of research. All applications must be typed. Leaders of expeditions and applicants for grants will be expected to attend an interviewing board.

GEOGRAPHICAL ESSAY PRIZE

Candidates are reminded that essays must be submitted to the Director and Secretary by 15 January 1954. As announced in the *Geographical Journal* for June and September, a prize of £10 will be awarded for the best geographical essay not exceeding 5,000 words in length, including sketch maps and diagrams, written by a student reading geography at a university in Great Britain or Northern Ireland during the academic year in which the essay is submitted. The Council reserves the right to publish or to retain for the Library any of the essays received.

THE RECORD

CONTRIBUTORS TO THIS ISSUE OF THE *JOURNAL*

Brigadier Sir John Hunt was the leader of the successful British Mount Everest Expedition of 1953, and is now Assistant Commandant of the Staff College at Camberley; *Sir Edmund Hillary*, who reached the summit of Everest, is a bee-keeper from New Zealand and has climbed extensively in his own country and in the Himalaya. *The Honourable Lionel Chevrier*, Q.C., M.P., has been Minister of Transport in the Canadian Government since 1945; he was Secretary of the Cornwall Board of Trade for many years before being elected to Parliament in 1935 and has been throughout his career a strong advocate of the St. Lawrence seaway and power project. *A. A. Grigoriev* contributed an article to the *Journal* in June 1952 on power projects and developments in the U.S.S.R.; he is a Medallist of the Russian Geographical Society and holds the post of Director of the Geographical Institution of the Academy of Sciences. *Mr. D. G. Bunker* joined the staff of the Desert Locust Survey in 1949 and spent four years travelling in Arabia; he is now on the staff of the Department of Survey in Kenya. *Dr. E. C. Willatts* is a Senior Research Officer in the Ministry of Housing and Local Government and *Mrs. Marion G. C. Newson* is a member of the research staff of that Department. *Mr. G. R. Crone* is the Society's Librarian and Map Curator. *Mr. W. B. Morgan* became Assistant in the Geography Department of Glasgow University in 1948 and in 1951 went to Africa under the auspices of the Department of African Studies in that University; he was recently appointed Lecturer at University College, Ibadan, Nigeria.

UNIVERSITY NEWS

CONFERENCE

The fourth Inter-Varsity Geographical Conference is being held at Bedford College, Regent's Park, London, from 11–16 April 1954. Further details in the *Journal* for March, 1954.

UNIVERSITY COLLEGE OF SWANSEA

An Honours school of Geography was established within the Department of Geology and Geography at the beginning of October 1953, and Mr. J. Oliver is the Lecturer in charge of geography. New accommodation and equipment has been provided for the additional students and Mr. F. V. Emery, a research student from Oxford, has joined the staff as an assistant lecturer in geography.

Further staff appointments and extra accommodation are anticipated in the future. Geography thus becomes a subject which can be read to the Honours level in the Faculties of Arts and Science.

GEOGRAPHY DEPARTMENTS IN WEST GERMAN UNIVERSITIES

This short report is based on a visit during the summer Term 1953 to the Geography Departments of the West German Universities of Münster, Kiel, Göttingen, Frankfurt, Heidelberg, Bonn, Cologne and Mainz, and to the *Technische Hochschulen* of Brunswick and Hanover.

Accommodation and equipment

Despite the total or partial destruction of the premises of many of the departments during the war, reconstruction has proceeded rapidly, especially during the past four years, and full advantage has been taken of the opportunity to re-plan and to install up-to-date equipment. At Kiel and Cologne entirely new premises have been constructed, while the pre-war Institute at Bonn has been rebuilt on ultra-modern lines. The Department at Münster occupies a reconstructed wing of the Geological Institute, while those at Göttingen and Frankfurt are established in large houses. At Mainz Geography is incorporated in the very compact block of the main University building, which now occupies a former barracks on the outskirts of the city. At most universities new laboratories and lecture rooms are fitted with electrically operated blinds, controls for dimming lights and ample fittings for the display of maps. The fine library collection of the Department at Kiel was fortunately preserved throughout the war, but losses at many other universities were heavy and most departments suffer from a deficiency of pre-war standard works. Similar losses occurred in map collections, but Heidelberg was fortunate in preserving most of its material.

Staff

The Head of each department is appointed by the university, with the approval of the State, and ranks as an Ordinary Professor. His staff includes a number of *Dozenten* and *Assistenten*, of academic status, as well as various technical and clerical personnel. A *Dozent*, who is equivalent to a Lecturer, holds the Doctor's degree and has qualified to teach in a university by presenting a second thesis of outstanding quality. A *Dozent* of six years' standing may gain the title of Extraordinary Professor by successfully presenting a lecture to the academic staff of the whole Faculty and answering questions thereon in an open discussion. The *Assistent*, who is similar in status to a Demonstrator, usually holds the Doctor's degree, pursues his own research, helps with the organization of the library, practical work and field excursions, but is seldom required to give lectures. The numbers of the full-time academic staff in the various departments are very variable, ranging from about eleven in a large institute, such as Bonn, to seven at Göttingen, five at Heidelberg and Münster, four at Kiel and Frankfurt, and only two at Cologne and Mainz. The staffs of the *Technische Hochschulen* seldom exceed three or four. Full details of the academic staffs of the various departments are given in the very useful annual publication entitled *Geographisches Taschenbuch* (*Jahrweiser zur Deutschen Landeskunde*),[1] which also includes information on geographical societies and related institutions in such fields as geology, meteorology, cartography or town and country planning. Since the overthrow of Nazism regional differences on political and religious grounds have been accentuated in the Federal Republic,

[1] Published by *Reise- und Verkehrsverlag*, Stuttgart.

and university appointments may at times be affected by considerations of religious persuasion. Thus the University of Münster has a traditional Roman Catholic background, whereas Kiel, Hanover, Heidelberg and Göttingen are strongly Protestant.

Curriculum

Students are prepared for two examinations: (*a*) the State Examination, taken after four or five years of study, which qualifies students to teach in schools, and (*b*) the Doctorate in Philosophy, or in Natural Sciences, awarded solely by the University after a period of study usually extending from five to seven years, and not recognized by the State as a qualification to teach. The examination system in Germany is very different from that in Britain, there being no intermediate, terminal or sessional papers before the State Examination or the presentation of the Doctor's thesis. At Heidelberg, where geography since the days of Hettner has belonged to the Faculty of Philosophy and not to Natural Sciences, there are now about 120 students, of whom approximately 25 take geography as a major subject and only two or three prepare for the doctorate. In the large department of Bonn there are now 150 students, of whom about half take geography as a major subject and as many as 20 study for the doctorate. Students taking geography as a major subject, equivalent to Honours standard, must study two subsidiary subjects, such as history, German, a foreign language, geology, biology, chemistry, physics or mathematics, for at least four years. The curriculum in the majority of the departments visited appeared much less rigid than in Britain and students are not required to attend so many lectures. For example, at Kiel students are expected to read much of the basic material for themselves, and lectures are devoted to special aspects of systematic and regional work. In particular the regional geography of the major continents is not covered so comprehensively as in many British universities. Germany, as one would expect, is studied in considerable detail in most departments but problems of its political definition have to be reconciled. Should the boundaries be those of the new Federal Republic of Western Germany or those of the Reich before 1938? Can one obtain reliable data, particularly statistical, for the Eastern Zone? At present many of the departments concentrate on studies of typical German landscapes on both sides of the inter-Zonal frontier rather than attempting a comprehensive regional treatment of the now-divided Germany. Geopolitics, which once occupied an important place in the curriculum at many universities during the Nazi period, no longer forms a separate course and little reference is made to it.

Tutorial work with small groups of students is not an accepted practice in Germany, possibly because of shortage of staff, but seminars—usually of two grades—are held at which students give a lecture on a special topic followed by a general discussion. After satisfactorily presenting two papers to the lower seminar a student may apply for admission to the upper. The most important meeting is the *Kolloquium*, usually held fortnightly, at which staff and students are addressed by an expert in some particular field of geographical research. Members of other university departments, especially geologists, historians and town planners, are usually well represented at these lectures which are followed by a vigorous discussion often extending well beyond one hour. Intensive studies of the local area, based on field-work, form an essential part of the Geography course and annual excursions lasting a week or a fortnight are held at home or abroad. The department at Kiel proposes to solve the difficulty of transporting parties of students engaged in field work by purchasing a small *Volkswagen* 'bus with seats for twelve.

Research

In all the departments visited research work appeared to be making good progress, whilst the publication of results was in a much more satisfactory position than in Britain. Most departments regularly issue their own publication, such as the *Göttinger Geographische Abhandlungen* or *Westfalische Geographische Studien* (*Münster*), containing research papers by academic staff and post-graduate students. These publications are widely exchanged with other universities at home and abroad, and departmental libraries benefit thereby. Publications on these lines by the geography departments of British universities would be a progressive step, as much research work of very high quality presented by post-graduate students now remains in university archives and never appears in print. The present interest of German academic geographers, from Professor down to *Assistent*, in research work and travel abroad is truly remarkable, and ample funds from such bodies as the Ministry of Education or the *Deutsche Forschungsgemeinschaft* appear to be available to support such activity. Since the end of the war many have been engaged in geographical work abroad, usually for periods of about six months or one year, while very few of those remaining in Germany do not cherish some scheme for research work in a foreign country. For example, the Head of one department has spent all but nine months of the past two years in Britain, South America and the United States while another plans to spend the next two years in India and Pakistan. Such facilities for leave of absence and travel clearly encourage the prosecution and publication of geographical research, while at the same time helping to foster good international relations, but it is obvious that the students suffer to some extent from such frequent and prolonged absences of academic staff. By comparison, the average British student appears to receive a more careful and comprehensive training with close and continuous contact between staff and student.

The German public as a whole is keenly interested in up-to-date information about foreign countries, and the various geographical societies associated with the universities attract large appreciative audiences to their illustrated lectures. For example, over six hundred people in Bonn recently attended a lantern lecture on Malaya arranged by the *Gesellschaft für Erd- und Völkerkunde*, while another large audience at Hanover heard Professor Kolb of Hamburg describing his travels in Australia during the past year. The popularity of geographical lectures of this kind appears to be the result of a general reaction to the former Nazi policy of restricting contacts with foreign countries.

In concluding this brief and necessarily incomplete account, the writer wishes to record the kindness and courtesy with which he was everywhere received. He was most impressed not only by the keen interest which the German universities displayed in British academic geography, but also by the firm desire for international cooperation and understanding which both staff and students expressed. H. T.

MAPS OF CORNWALL

As part of the Coronation celebrations in Cornwall, a Festival of Music and the Arts was held at St. Ives. This included an exhibition of Cornish maps and estate plans, organized by Mr. Treve Holman, who has furnished an account from which the following details are extracted. The exhibition was supported by the Duchy of Cornwall, the Royal Institution of Cornwall, the County Record Office, and private landowners. The county maps, charts and road maps displayed included examples of well-known cartographers from Saxton to Thomas Martin, who published a large map of Cornwall in 1784.

Manuscript estate p'ans formed an unusually striking feature, particularly two volumes of the great Lanhydrock atlas. These surveys of the Robartes' manors and farms, mostly on a scale of 1 : 4,000, were made in the last decade of the seventeenth century and are in effect land use maps. The Atlas was compiled before all traces of the medieval field systems had disappeared, and many of the farmsteads and townships show the medieval field plan unaltered. They are anonymous, but have been attributed to George Withiel. Another fine estate atlas was that of the Hon. Francis Boscawen's western properties made by Charles Moody in 1778.

A NEW MAP OF BELGIUM, 1/50,000

In 1945, the Institut Géographique Militaire of Belgium embarked on a new series of maps of the country, the base being a new map on the scale of 1/20,000 from air survey. The execution of this was expected to occupy twelve or fifteen years. Later it was decided to adopt the scale of 1/25,000 and to issue further series at 1/50,000; 1/100,000; and 1/250,000. Pending the realization of the basic survey, the Institut in 1951 undertook the publication of a provisional series at 1/50,000 to replace the old 1/40,000 series. This is known as 'La nouvelle carte de Belgique au 1/50,000^{e} type rapide,' and is a reduction of the 1/40,000, brought up to date by details from air photographs, and partially revised in the field. The aim has been to produce a clear and easily legible map of the characteristic features of the countryside with emphasis on communications and settlement. The map is in five colours, with main roads in red, water in blue, woods in a flat green without symbols, and built-up areas in solid black. Relief is shown only by contours in brown, at 5, 10, or 20 metres interval, according to the terrain. Given the provisional basis on which the map rests, the claim is justified that it is "une carte tactique moderne, précise, claire, fidèle et très lisible." It comprises 74 sheets, and is to be completed before the end of 1954. Details of the map and the methods of production are given in a short pamphlet by R. Devos, Director of Cartography at the Institut.

LAND STUDIES IN AUSTRALIA

Mr. C. R. Twidale has sent to the Society a detailed paper on the extensive land studies carried out by the Land Research and Regional Survey Section of the Commonwealth Scientific and Industrial Research Organization in Northern Australia, under the direction of Mr. C. S. Christian. These studies have been undertaken in response to a request by the Northern Australia Development Committee for "a series of land surveys of under-developed regions in order that their developmental potential might be more accurately assessed." The methods applied are related to three factors, the great areas to be examined, the difficulties of travel, and the need of information within a reasonable period of time. The basis of the research is the conception of "land systems"; each area is first separated into geomorphological units characterized by a particular combination of structure, process and stage. The Barkly Tableland, for example, is classified in twenty-one units, which form three groups—*i.e.* of stable, erosional and depositional land surfaces. Special attention is given to the age and materials of the various units. Within the units, areas characterized by particular combinations of topography, soils and vegetation, and which are of a sufficient extent, are differentiated as "land systems," the areas varying according to the potential of the land.

The mapping of these systems is carried out by a field survey unit which consists of a geomorphologist, geologist, pedologist, botanist and ecologist, working in close cooperation with a climatologist.

The first stage is the preparation of mosaics from air photographs, now standardized at the scale of 1:50,000. After a study of the relevant literature, photo-patterns are delineated, mainly formed by geomorphological, soil and vegetation features, and traverses are planned to cover all types of patterns revealed. The team then proceeds to work along these traverses in the field, with the ultimate object of assessing the land potential. With the knowledge thus gained, a second photo-interpretation is carried out, and patterns plotted from field notes and by extrapolation of traverse data. In a second field session, any remaining problems are cleared up and interpretations checked. It is then possible to produce a compilation map showing boundaries drawn by all the scientists. The team having checked what areas are to be mapped as separate land systems, each member compiles his individual map and report. When the various land systems have been classified, the potential land use is assessed and recommendations as to future development possibilities are made. Two research stations have been established to conduct further research in soil fertility and management.

Four areas have been surveyed since 1946: Katherine–Darwin area (27,000 square miles); Barkly Tableland (120,000 square miles); Ord–Victoria area (83,000 miles) and Townsville–Bowen area (6,400 square miles). In 1953 and 1954 the unit will survey the Gulf area of north-west Queensland, and a newly formed team will be at work in New Guinea.

Students interested in the technique briefly outlined above may consult Mr. Twidale's detailed paper in the Society's Library.

The Library has also received the first two reports in the 'Land Research Series' published by the C.S.I.R.O. The first of these, 'General Report on Survey of Katherine–Darwin Region, 1946,' by C. S. Christian and G. A. Stewart (Melbourne, 1953) recommends the consideration of a general plan for the development of the region, based on the establishment of an agricultural community raising fodder and summer cereal crops, exportable crops, including tobacco and peanuts, and fruits and vegetables; also the establishment of a meat processing works. The body of the report follows the research scheme outlined above, and has a number of illustrations of vegetation types. The maps include a reconnaissance geological map and a land system map on the scale of 8 miles to 1 inch. Development should begin with the further investigation of areas of suitable soil, large enough for a community of reasonable size with the necessary services. The present white rural population is estimated not to exceed one hundred.

The second report on the Townsville–Bowen region of eastern Queensland was prepared mainly in connection with proposals for developing the irrigated areas on the lower Burdekin river. It is considered that outside the Burdekin scheme there is little prospect of expanding irrigation in this area.

RAISED FEATURES ON THE WEST COAST OF VESTSPITSBERGEN

These notes on the raised marine features in the St. Jonsfjorden–Eidembukta region of Vestspitsbergen were made in the summer of 1951. The features on the coastal plain or strandflat of the west coast occur under rather different conditions from those of the fjords, and have several interesting characteristics. Raised features have been noted at many points along the western coast of Vestspitsbergen, but no comprehensive survey over a wide area has yet been accomplished. Peach [1] has suggested that on the nearby Prins Karls Forland the most prominent and widespread raised features occur at about 25 feet,

[1] A. M. Peach, "The pre-glacial platform and raised beaches of Prince Charles Foreland," *Trans. Edinb. Geol. Soc.* 10 (1916) 289–307.

50–70 feet, 150 feet and 240 feet, the 50–70 feet beaches being characterized by the abundance of *Saxicava*. Feyling-Hanssen and Jørstad [1] in a study of the raised beach faunas of the Sassen area, suggest a possibility of correlating raised beach deposits on a palaeontological basis. In their area they recognize several zones in which raised marine features are commonest and suggest that broad horizons may be distinguished by their included faunas. In the Billefjorden region Balchin has found the raised marine features to be inclined,[2] and the need for correlating deposits on a palaeontological basis where this may take place is obvious.

St. Jonsfjorden

Where mountain screes, glaciers or glacial deposits do not occupy the strip of foreground, less than 300 yards across, between mountain and coast in the fjord, raised marine features may be preserved. Wave-cut platforms and cliffs are rare, and sloping banks of shingle, to which it is often difficult to give a general height, predominate. They occur most frequently between certain heights; there is a well-marked 12–15 foot raised shingle beach, numerous deposits around 25 feet, 50–70 feet and a few at about 100 and 150 feet. Above this level features are very scarce.

The lowest raised deposits occur at a very few points along the coast, and are being rapidly removed. At Piriepynten they reach 18 feet above sea-level and rest upon a wave-cut platform at 15 feet. Features around 25 feet above sea-level are found at a few isolated points between Müllerneset and Lovliebreen, generally as thick patches of shingle, often resting on wave-cut notches. Remnants of a beach at 100 feet are preserved below Bulltinden, Copper Camp and Holmesletbreen. East of Lövliebreen, on Bulltinden and below Thorkelsenfjellet, shingle is preserved at levels between 130 and 150 feet. Poor narrow platform-like features at 240–250 feet were noted immediately east and west of Holmesletbreen.

Thus above 100 feet the evidence is poor, but it is apparent that features have been formed at intervals during the rise of land some 250 feet relative to present sea-level. Throughout the fjord there is no indication of a local tilt to the raised features such as Balchin demonstrated in Billefjord. The tilts there were believed to be due to local recovery, controlled by tectonics, rather than due to a regional cause. The tectonics of the central part of Vestspitsbergen are conducive to this view, but in the St. Jonsfjorden region the beaches lie upon a comparatively stable block of Hecla Hook rocks, and no such tilts would be expected to be apparent over so short a distance as the fjord.

The relationship of the raised features to the moraines is interesting since, as seen at Copper Camp, marine shingle rests upon a polished and striated rock shingle and is in turn overlain by moraine. The fjord may have been ice-filled to the east of Charlesbreen at the time of beach formation, or the Osbornebreen which now occupies the head of the fjord may have since readvanced, destroying all the marine features. The shingly nature of the lateral moraine of Osbornebreen suggest that this may be the more likely reason.

The strandflat

Along the western and northern coasts of Vestspitsbergen, wide, low-lying plains form a conspicuous part of the relief. These plains, or strandflat, main-

[1] R. W. Feyling and F. A. Jørstad, "The Quaternary faunas," *Norsk Polarinstitutt Skrifter*, Nr. 94 (1950) Oslo.

[2] W. G. V. Balchin, "The raised features of Billefjord and Sassenfjord, West Spitsbergen," *Geogr. J.* 97 (1941) 364–76.

tain a remarkably low level over wide areas and terminate inland very abruptly. It is a rather different strandflat from that of Norway, not being dissected into innumerable little islands and skerries, and it is not found within the confines of the fjords. Much has been written concerning the origin of the strandflat. Peach concluded that it was of pre-glacial age, and that the beach deposits had no genetic relationship to it. Nansen, like Hoel, considered that it was a relatively young feature, its level surface not having been exposed to the erosive action of the Pleistocene glaciation. Planation to strandflat level may have taken place during inter-glacial periods, according to Nansen, when the ice covering was similar to what it is to-day.

Holtedahl [1] maintains that the Spitsbergen strandflat must post-date the time when Forlandsundet and Isfjorden were filled with ice, though it is recognized that there have been extensive readvances of the ice since that time. The absence of the strandflat, or of any important similar feature within the fjords is thought to be due either to an advance of the ice after the formation of the strandflat or to the existence of glaciers there at the time. Ahlmann [2] has pointed out that in Greenland there is no strandflat for the country is still covered by a continental ice-cap, and must now be depressed to a position similar to that from which Spitsbergen has been raised with the regression of glaciation. This same author later postulated strandflat formation in Tertiary times by sub-aerial erosion and by marine abrasion during Pleistocene times. Strøm [3] suggested that the Norwegian strandflat suffered marine abrasion in Tertiary times and final sculpturing by the Pleistocene glaciations. In Spitsbergen the glaciation has been more prolonged and post-glacial uplift more rapid, and the strandflat has not suffered dissection into small islands and skerries. Clearly the strandflat was formed prior to the raised beaches up to 150 feet, and has since been partly re-covered by glaciers which have left large erratics dotted about the surface. Distinct shore-lines and terraces are rare. Near the coast the shingles are often very fossiliferous, containing great numbers of *Mytilus edulis*.

The greater part of the strandflat between Müllerneset and Eidembukta is occupied by the 50–80-foot spread of shingle. The highest shingles found in this area occur on the slopes of Jørgenfjellet at 200 feet, and are virtually the only traces of marine deposition above 150 feet. Near Eidembreen, however, raised wave-cut cliffs at about 200 feet above sea-level were found. In Trygghamna, at the south-eastern extremity of Daudmannsøyra, previous workers have recorded raised deposits. The general heights given are 15–18 feet, 30 feet, 57 feet and 166 feet.

Thus there is a close correspondence between the figures one may quote for the common heights of raised features in St. Jonsfjorden, upon the west coast strandflat and in Trygghamna. A study of the faunas collected from raised deposits in the present area suggests that correlation upon a faunal basis may be a difficult matter on the west coast, for the assemblages in the fjords are rather different from those at the same levels on the strandflat.

Conclusion

In the St. Jonsfjorden–Trygghamna region the indications are that some groups of raised features persisting with a constancy of height and development,

[1] O. Holtedahl, 'On the geology and physiography of some Antarctic and Sub-Antarctic islands.' (1922). Oslo.

[2] H. W. Ahlmann, "Studies in north-east Greenland, 1939–40," Parts I–IV, *Geogr. Annaler* (1943) 145–210. Stockholm.

[3] K. M. Strøm, "The geomorphology of Norway," *Geogr. J.* 112 (1948) 19–27.

may be distinguished. Figures from other parts of north-west Spitsbergen suggest that this constancy is maintained over a wide area (see table below). Most of the figures are for localities upon the pre-Carboniferous block of the north-west, not affected by Tertiary earth-movements. So far no tilted raised features have been detected there, and the recent isostatic recovery of this part of Vestspitsbergen has been of widespread uniformity, with periods of slower

Zone height in Sassen area (Feyling-Hanssen and Jørstad)	*Levels in present area*	*North-west Spitsbergen* (Orvin, Hoel, Freebold and others)
3·6 metres	12–15 feet lowest raised features	
7 metres	25–30-foot features. Peach's 25-foot Beach on Prins Karls Forland	8 metres (widespread)
10 metres		14 metres (widespread)
20 metres	40–80-foot numerous beaches. Peach's Saxicava Beach, 50–70 feet	
27·6 metres		27–28 metres
32·3 metres	100-foot few well-marked levels	34–36 metres
45 metres	150-foot raised beaches. Peach's 150-foot Beach	45 metres
59 metres	240–250-foot few features	53–55 metres
63 metres		77–79 metres (widespread)

emergence when the most extensive wave-cut and raised beach features were formed. This uplift appears to have been completed by the time the glaciers reached their last major extension. In Billefjorden five distinct major episodes of uplift can be traced, corresponding perhaps to the intervals between the more prominent zones recognized by Feyling-Hanssen and Jørstad. The state of affairs in Billefjorden may be found to exist in other parts of Vestspitsbergen, but it seems likely that the major episodes of uplift will be found to have had their effect over a very wide area, and to be the same as those which have uniformly raised the country to the north-west. With the extension of studies along the western coastlines it is possible that these uplifts will be recognized there as well. D. L. D.

AUSTRALIAN EXPEDITION TO MACROBERTSON LAND

It was announced in September, by the Antarctic Division of the Australian Department of External Affairs that a new research station was to be set up in the Australian Antarctic, and that a wintering party of ten men would leave for MacRobertson Land on December 12. The Danish motor vessel *Kista Dan* (Captain H. C. Petersen) had been chartered for the voyage, which was to include a survey of parts of the Antarctic coastline and some soundings of uncharted waters. Mr. P. G. Law, Director of the Antarctic Division, sails in the *Kista Dan* and will supervise the establishment of the new station which will be manned for next twelve months by a party under the command of Mr. Robert G. Dovers, Surveyor. Captain Le Gall, of the French administration on Kerguelen Island, is also on board at the invitation of the Australian Government. The *Kista Dan* will call at Macquarrie, Heard and Kerguelen Islands, and she is due back at Melbourne on March 14, having left Mr. Dovers and

his team at their post. She is carrying two Auster aircraft, to help in negotiating the pack-ice and to be used during the forthcoming months in reconnaissance over the Antarctic mainland; these aircraft will be in the charge of Flight-Lieutenant Leckie of the R.A.A.F.

The programme of work for 1954 is a heavy one. Five huts are to be built and equipped as a base from which a cartographical and geological survey of the surrounding country is to be undertaken. A range of up to 300 miles from the station is to be covered by means of tracked snow vehicles, or "weasels," and dog-sledges. Meteorological, biological and geophysical problems are to be studied with special attention to the Aurorae Australis, to sea-ice phenomena and to tidal movements.

This new expedition will owe much to previous ventures into the Antarctic; to begin with, the administrative machinery set up by the Antarctic Division for the supply and maintenance of the Heard and Macquarrie stations has simplified the choice and despatch of stores. Radio transmitters of a type designed for the R.A.F. during the war and used on Heard and Macquarrie for the past six years have proved dependable and will be issued to Mr. Dovers' team for wireless telegraphy to Australia. The hut in which the party will live is similar to those used by the Norwegian–British–Swedish expedition of 1949/52, and the improved type of dog-sledges is a legacy from the same expedition. These sledges, drawn by huskies trained on Heard Island, will supplement the American "weasels" which it is proposed shall haul "caravans" of Australian design and manufacture in which the men can work, eat and sleep. An interesting point is that the polar tents, now being made in Britain, vary little from those used by Scott in the Antarctic some fifty years ago.

THE INTERNATIONAL ASSOCIATION FOR QUATERNARY RESEARCH

British geographers do not seem to be sufficiently aware of the work of the International Association for Quaternary Research (commonly known as INQUA) which held its fourth, and first post-war, Congress in Italy in August and September 1953. The session of the congress, under the presidency of Professor G. A. Blanc (Rome), was held for six days in Rome and then for five days in Pisa; the business meetings were liberally interspersed with local excursions from those centres (to Monte Circeo, in the Campagna, to the Garfagnana and the Apuan Alps, to Volterra, and from Rome to Pisa). In addition longer excursions before the Congress visited (1) the Abruzzi, Apulia, Salerno and Naples; (2) Sicily and Naples; and after the session (3) the Riviera and Nice. The excursions, especially the longer ones, were among the most valuable parts of the Congress, at least to the geographer, and were concerned with many samples of the very varied Quaternary geology of Italy: ice action, recent faulting, Pleistocene sedimentation and terracing both in interior basins and in coastal areas, Pleistocene volcanic activity and its relation to sedimentary stratigraphy, and Paleolithic archaeology, especially that of the coastal caves, which have yielded very rich material.

Especial emphasis was placed, probably wisely, on the less well-known parts of Italy, in some of which geological and archaeological work along modern lines has scarcely begun. Many participants, even those to whom Italy is comparatively familiar, will be grateful to the Congress for introducing them to many of its lesser known glories—the wild limestone gorges and isolated basins of the Abruzzi, the magnificent architectural *ensembles* of the Southern Apulian towns such as Lecce and Martina Franca, the Cilento coast, and the Greek cities of Paestum and Segesta. Another admirable impression derived from

these excursions was the widespread local interest in and support for learning especially striking in the more remote areas.

The papers read before the Congress varied very widely in scope from ethnology to geochemistry, and included a wide range of regional studies many of them of interest to geographers. Particular mention should perhaps be made of geographical contributions by Professor Troll (Bonn) on the climatology of the snow-line and of areas subject to periglacial action, and by Dr. Tricart (Strasbourg) on the periglacial phenomena of the Southern Alps, and of a number of papers by Professors Stout (Nebraska), Flint (Yale), and van der Vlerk (Leyden) on interregional correlation of the subdivisions of the Pleistocene.

No report of this most successful congress can conclude without some reference to the remarkable work of the three secretaries, Professors A. C. Blanc, E. Tongiorgi and L. Trevisan, who not only organized the congress, but largely led the excursions and prepared the numerous excursion handbooks, which are valuable guides to the Quaternary geology of the regions visited. The publications of the congress and the transactions in due course are obtainable from the General Secretariat, c/o Instituto di Geologia, Via S. Maria 31, Pisa.

The next congress is to be held in Spain in 1957. A. F. M.

NAVIGATING ASHORE

In the April 1953 number of the Journal of the Institute of Navigation there appeared an interesting paper by Brigadier Bagnold, F.R.S., on "Navigating Ashore." This subject is of particular interest to geographical explorers as, apart from those engaged in certain military operations in the desert and polar regions, it is they who are the sole practisers of this art.

In his lecture Brigadier Bagnold was talking principally to marine and air navigators and stressed the fact that on land, estimates of distance by dead-reckoning could be accurate to between 1 and 1½ per cent., there being no drift effect to allow for. On the other hand, the need for the rapid transferability of instruments and gear from one vehicle to another meant that elaborate electronic devices were out of the question. This changing of vehicles and ever changing distribution of the load within the vehicle did not justify a lengthy and elaborate adjustment for the compensation of magnetic compasses, and they had not been used for that reason.

This point was taken up in the ensuing discussion by Commander May, who was inclined to disagree and claimed that even in the most heavily armoured vehicle, at a slight expense, a magnetic compass could be sited on the wind screen for example, and the changes in the distribution of the load could be arranged so that the magnetic part of the load had little effect compared with the more permanent effect of the main structure and electrical installations of the vehicle.

Apart from the practicability or otherwise of magnetic compasses Brigadier Bagnold maintained that in certain conditions sun compasses were essential and most satisfactory. He described their basic principles and pointed out that for following a pre-determined course, the Cole's Universal Sun Compass was admirably suited, but his own pattern—the Bagnold Sun Compass—was better suited for reading the actual course being followed at any particular instant. He suggested a means whereby the compass sited on the roof, clear of all vehicle shadows, could be read from inside an enclosed vehicle by means of a periscope.

Measurements of distance in desert and ice cap conditions were described, including sledge wheels, speedometers and automatic plotters. This part of the paper was summed up by the author by stating that although a continuous and accurate log of the distances and bearings could not be kept, an experienced

land navigator could average his bearings and adjust his distances over a day's run and finish up with an error of about 1 per cent.

In considering the very simplest form of astro-fix for land navigation where a fix to about 1 mile was sufficient, Brigadier Bagnold mentioned a very simple but ingenious instrument designed during the war by Professor Thompson. A full description of this "astro-clinometer" with drawings appears in the paper and although from the discussion it appeared that there was little demand for it in its present form by explorers in peace time, it was agreed that the principle was very suitable for training students in making astro-fixes, and it also provided the basis of a device that could be attached to the standard theodolite for finding and identifying stars.

Following the paper Mr. G. de Q. Robin and Mr. A. Stephenson referred to methods of navigation used in the Antarctic and Greenland.

In the extremely interesting and instructive exhibition on "Navigation To-day" which is being held in the Science Museum and which it is proposed to continue until the end of the year, there is a small section illustrating "Land Navigation" in which all the instruments referred to by Brigadier Bagnold are on view. A. S.

THE MEETING OF THE BRITISH ASSOCIATION, 1953

The 115th meeting of the British Association for the Advancement of Science, held in Liverpool from 2 to 9 September under the kindly and efficient presidency of Sir Edward Appleton, G.B.E., K.C.B., F.R.S., was the sixth to be held in that city, the first being as far back as 1837 and the latest in 1923. It was a very satisfying and enjoyable meeting well worthy to take its place among the recent sequence of distinguished meetings. There have not been lacking during some of those meetings voices raised in the popular press to decry the Association and suggest that it no longer has a vital public function to fulfil: the large attendance and success of the Liverpool meeting, as well as the fact that the Association has already received and accepted invitations to hold meetings, in this order, in Oxford, Bristol, Sheffield and Dublin in the next four years, effectively gives the lie to any such suggestion. The British Association may not be what some would wish it to be but it is clearly doing something that appeals to many.

Section E met under the presidency of Professor R. H. Kinvig in the commodious premises of the University School of Architecture. The Section room itself was not over large and on a few occasions failed to accommodate all who wished to be present, but more notable was the fact that it was consistently well filled (with 120–150 persons) throughout the meeting. There appeared to be more than a nucleus of regular attenders. In his presidential address on "The Geographer as Humanist," Professor Kinvig naturally paid tribute to the work of the late Professor P. M. Roxby who gave the Liverpool School of Geography, and indeed, a good deal of human geography in this country, its distinctive stamp. Perhaps it was equally natural that the press should notice only his references to the problems of racial geography in the modern world.

The sectional transactions could largely be said to fall into a series of sessions each devoted to a particular topic. Notable among these was the opening session which dealt with the geography of Merseyside, with a most illuminating account of the region by Professor Wilfred Smith, a particularly well-illustrated account of the evolution of the coastline of south-west Lancashire by Mr. R. Kay Greswell, and an account of the application of cartographic techniques to the investigation of the problems of the journey to work on Merseyside by Professor Smith and his research assistants, Messrs. G. Mercer and K. Rowe.

Another session, Friday afternoon, was devoted to aspects of the wider region in which Liverpool is set, with papers by Mr. Simpson on Cheshire Dairying and by Mr. J. A. Taylor on the use of the Lancashire and Somersetshire peatlands, and one by the late Hereward Jensen on physiographic changes in the Dee estuary read by his close friend Mr. F. J. Monkhouse. Monday morning was a central and western European session in which Dr. K. A. Sinnhuber discussed the concept "Mitteleuropa," Professor Edwards spoke of the geographical basis of Benelux and Professor Pounds—a welcome returning summer migrant, shall we say, from Illinois—of the functional connections between Lorraine ore and Ruhr coal. On Tuesday morning a group of papers on African subjects made an equally interesting session: Dr. Monica Cole spoke on citrus fruit growing in South Africa, Mr. T. E. Hilton gave an account of the making and meaning of the population map for certain districts of the Gold Coast Northern Territories which threw a flood of light on the nature and difficulty of problems of African geography, while Dr. H. R. Jarrett provided a well considered account of the growth of Freetown, Sierra Leone. But all the papers presented were, or could be, grouped in this way. Dr. Moodie's paper on "Agrarian reform in east central Europe" would have overcrowded the European session; others by Professor Lebon on Baghdad (kindly read in his absence in Khartoum by Dr. D. H. Davies), by Miss Chew on Leicestershire agriculture since 1939, by Miss Third on eighteenth century Scotland, by Mr. N. Stephens on the longitudinal profiles of some Dartmoor rivers, by Mr. F. A. Barnes on ephemeral cold fronts in the English Midlands and by Mr. O. Hinchliffe on the results of an investigation into the reasons why people in a Pennine valley change their place of residence, were all too diverse to be streamlined into a ready-made grouping but were much welcomed for the variety of interest which they offered.

Section E contributed to one joint discussion, that with Section D on "The Continental Shelf": there Dr. A. E. Moodie performed a valuable service by drawing attention to the issues of political geography involved in modern, economic exploitation of the continental shelf and its waters. An innovation, at any rate as far as Section E is concerned, was made at this meeting. It took the form of two illustrated lectures intended for rather junior audiences, given not in the Section rooms, but in a larger hall. One was by Professor Peel on "The forests, mists and snows on Ruwenzori—an account of the expedition of 1952" and the other by Mr. N. Pye on "Life and Livelihood in the Arizona Desert." Both were deservedly successful.

Organization was excellent and owed much to Professor Smith and all members of staff of the University Department of Geography, but especially to Mr. F. J. Monkhouse, the local secretary. To him we owed the arrangement of a well attended and most pleasant dinner at the Constitutional Club at which Professor Kinvig presided and Professor Derwent Whittlesey was our sole overseas guest. To Mr. Monkhouse and his colleagues we owed a fine set of excursions which were all blessed by good weather. But perhaps the greatest debt which Section E and geographers generally owe to the Liverpool School is the publication *Merseyside—A Scientific Survey* which was distributed to all members. This handsome volume of 300 pages edited by geographers, and of which some two-fifths were written by geographers, is probably the most geographically informed and informative survey of the kind yet produced. Geographers who were not at the meeting are well advised to order a copy from the Liverpool University Press while stocks last.

Next year's meeting will be held at Oxford from 1 to 8 September where Dr. E. D. Adrian, O.M., P.R.S., will preside, while Section E will be under the

presidency of Professor J. A. Steers. Offers of papers to be read at this meeting should be sent immediately to the Recorder, Dr. A. E. Moodie, Birkbeck College, University of London, Malet Street, London, W.C.1. D. L. L.

OBITUARY

PROFESSOR ALFRED PHILIPPSON

1864–1953

Geographers all over the world will be deeply moved by the news of the death of the doyen of German geographers, A. Philippson, Emeritus Professor, D.Phil., D.Sc. honoris causa. Although on the threshold of his ninetieth year, his mind had remained alert and he was able personally to direct the editing of his great work on the regions of Greece, which may be considered the culmination of his life's achievements, but he was only spared to see the first volume of it actually published.[1] This recent work and earlier publications on various aspects of the geography of Greece as a whole [2] will perhaps retain a current value longer than his other publications.[3] It was in recognition of his important contributions in this field that he was elected a member of the Academy of Sciences of Athens. The frame of his regional work, however, was much wider. He wrote a geography of the Mediterranean region, which saw its 4th edition in 1922, and his regional geography of Europe (3rd edition 1928) is well known. His interest was also directed towards geomorphology, and his 'Principles of general geography' (2 vols., 2nd ed. 1930–33) is noteworthy. It would be impossible to mention here all his other publications, but one more shall be cited which characterizes a third facet of his work inspired by the love of his Rhenish home land and the town where he was born, where he spent most of his life, and where he died: Bonn. One of his latest publications, his monograph on the situation and development of this city, is indeed a masterpiece.[4]

After receiving his primary and grammar school education there, it was also at Bonn where he began his university studies which he continued at Munich and concluded at Leipzig by taking his D.Phil. as a pupil of Ferdinand von Richthofen. He returned to Bonn University where he became "Dozent" in 1891, remaining there till 1904. He then accepted an invitation to take up the Chair of Geography at Bern. In 1906 he became Professor at Halle, finally returning to the Chair of Geography at his home town in 1911. He retired in 1929, and the occasion of his sixty-fifth birthday was marked by a *Festschrift* to which many of his pupils and friends contributed. Then, relieved of his duties as head of a department, he could look forward to reaping the harvest of his life, but political developments in Germany frustrated this prospect. Being the son of a rabbi, his freedom of work was more and more interfered with and ultimately, aged seventy-eight, he was deported, together with his wife and

[1] 'Die Griechischen Landschaften,' Band I, Vittorio Klostermann, Frankfurt a.M. (1950–52).

[2] 'Land und See der Griechen,' Bonn (1905 and 1947). 'Griechenlands zwei Seiten,' *Erdkunde* I (1947), 144–62. 'Das Klima Griechenlands,' Bonn (1948).

[3] List of publications in "Festschrift für Alfred Philippson," Leipzig, Berlin (1930).

[4] "Die Stadt Bonn, ihre Lage und räumliche Entwicklung," *Bonner Geogr. Abhandlungen*, No. 2 (1947).

daughter, to the concentration camp, Theresienstadt. It seems indeed a miracle that he was able to survive and return to Bonn in July 1945, and, even more, that he was capable after this terrible experience of continuing his work where it had been forcefully interrupted by a dictatorship with a complete disregard for human values.

With the death of Alfred Philippson Germany has lost one of the last representatives of a generation of geographers that had its roots in the time of Ratzel and von Richthofen and led the way to the present era of German geography.

K. A. S.

WALTER RAVENHILL BROWN BATTLE

1919–1953

Walter Ravenhill Brown Battle was drowned on 13 July 1953 in a glacial stream in Baffin Island. He was born in Leeds on 23 December 1919 and was educated there, taking a degree in geography at Leeds University. He became a keen traveller and mountaineer, and in 1948 organized and led the first expedition to receive the official support of Leeds University; this was to East Greenland, where he made geomorphological and glaciological investigations on Pasterzebreen. Battle returned alone to the same general region in 1949 in order to continue his work, and afterwards came to Cambridge as a research student to make a special study of the action of frost and water in the formation of cirques. While working on this subject he conducted some experiments at the Jungfraujoch research station; and on two occasions he went to the Jotunheim area of Norway and worked with the Cambridge Jotunheim Expedition on Vesl-Skautbreen, a cirque glacier. In the summer of 1952 he went to McGill University and continued his studies as Senior Carnegie Fellow of the Arctic Institute of North America. At the time of his death he was working on Penny Highland, Cumberland Peninsula, with an expedition from the Arctic Institute. "Ben" Battle was a man of remarkable strength of purpose; his determination and tenacity were well demonstrated when he was organizing and carrying out his journeys to Greenland. His untimely death will give his many friends a keen sense of personal loss.

T. E. A.

GEORGE DUNCAN McGRIGOR

1868–1953

By the death of G. D. McGrigor on 12 February 1953, at the age of eighty-five, the Society has lost one of its oldest Fellows, for he had been elected in 1898. In his early years, McGrigor, who had a geological training, had travelled in Newfoundland, and throughout his life he retained a keen interest in its fortunes. The Library of the Society possesses a bibliography of Newfoundland which he compiled and until recently kept up to date. McGrigor took a warm and practical interest in the welfare of the Society, and was a generous friend to older members of the staff. Until ill-health and failing eyesight made travelling difficult, he was a frequent visitor to the Society's House, and particularly to the Library.

CORRESPONDENCE

OLD SHORE LINES NEAR CAMBER CASTLE

J. H. Andrews

In his interesting and valuable paper on "Old Shore Lines near Camber Castle" (*Geogr. J.* 119 (1953) 200), Captain H. Lovegrove makes use of several old maps of Rye Harbour in tracing former coastlines in this region. His "1695 Shore Line" is derived from a map in L. A. Vidler's 'New History of Rye' (1934). Vidler gives no exact date for the map, but suggests that it should be ascribed to about 1700; Captain Lovegrove, on internal evidence, regards 1695 as the more likely date. It is surprising that Vidler gives no exact date for the map, since the original manuscript map, of which he publishes a photographic reproduction, was certainly made from a survey of July 1698. It was included in a comparatively well-known volume of maps of south coast harbours, compiled with the object of determining which harbours between Dover and Lands End were suitable for regular use by the Royal Navy. A description of this survey is given in 'Sussex Notes and Queries,' vol. 6, p. 220. There are at least two manuscript copies of the survey, including the 1698 map of Rye on a linear scale more than double that of Vidler's reproduction, one in the British Museum (Sloane MS. 3233), the other in Brighton Public Library.

58 *Lodge Road, Croydon,*

14 *July* 1953

MEETINGS: SESSION 1953–54

Meeting of 14 September 1953. A joint meeting with the Alpine Club. The President of the Royal Geographical Society and the President of the Alpine Club (Sir Edwin Herbert) as joint Chairmen.

Paper: The Ascent of Everest. By Colonel Sir John Hunt, Sir Edmund Hillary and Mr. Alfred Gregory.

Joint Meeting with the Institute of Biology 17–19 September 1953. A symposium on "The Biology and Productivity of the Sea."

Meeting of 19 October 1953. A joint meeting with the Alpine Club at the Central Hall, Westminster. The President of the Royal Geographical Society in the Chair.

Paper: The Ascent of Everest. By Colonel Sir John Hunt, Sir Edmund Hillary and Mr. M. H. Westmacott.

Following the lecture, the President introduced Dr. T. G. Longstaff as one of the most prominent of the older generation of Everest climbers. Dr. Longstaff said: "I am sure that I represent the feelings of this audience in expressing our thanks to the lecturers and our admiration for what we have heard. There is no one made more happy by their success than the pioneers, many of whom are here to-night. We admire the strategy and finesse with which they achieved

their object; we admire their team spirit, the absence of any personal emulation, each member of the team doing the job for which he was best qualified. The Royal Geographical Society and the Alpine Club first both ran an Everest Expedition in 1907. Now, forty-seven years after we hear of the successful accomplishment of the efforts. Do not let us call it the conquest of Everest, but the successful accomplishment."

Meeting of 26 October 1953. A joint meeting with the Nutrition Society. A symposium on "The Provisioning of Expeditions in the Field." Papers were read on polar and tropical rations, and on high-altitude diets by Dr. L. G. C. Pugh of the 1953 Everest Expedition

Meeting of 2 November 1953. A joint meeting with the Alpine Club at the Royal Festival Hall, London. The President of the Royal Geographical Society in the Chair

Paper: The Ascent of Everest. By Brigadier Sir John Hunt, Sir Edmund Hillary and Mr. Alfred Gregory

Her Majesty The Queen, His Royal Highness the Duke of Edinburgh and other members of the Royal Family were graciously pleased to be present at this meeting. In introducing the speakers the President said:

"Your Majesty, Your Majesty The Queen Mother, Your Royal Highnesses, Your Excellencies, my Lords, Ladies and Gentlemen.

May it please Your Majesty on behalf of the Fellows of the Royal Geographical Society and their guests, and on behalf of members of the Alpine Club and their guests, here this afternoon, to receive our most loyal and heartfelt welcome. We are proud and delighted that Your Majesty, as Patron of the Royal Geographical Society, has graciously consented to attend this joint meeting and that you should be accompanied by His Royal Highness the Duke of Edinburgh, Patron of this year's Everest Expedition.

It is now over thirty years since the Society and the Club joined together to send expeditions to climb Everest. This year's expedition has been the eighth in succession, for the Society and the Club have been very persistent.

With Your Majesty's permission I will now introduce the lecturers this afternoon. On my right Sir John Hunt, the leader of the expedition, and on my left Mr. Albert Gregory and Sir Edmund Hillary. Sir John Hunt will be the first speaker."

AMENDMENT TO THE *JOURNAL* OF SEPTEMBER 1953

It is much regretted that certain Crown Copyright photographs were used to illustrate Professor J. A. Steers' paper on "The East Coast floods" (*Geogr. J.* 119 (1953) 280–98) without due acknowledgement to the Air Ministry. The following Royal Air Force photographs were used :—"The beach at Palling," facing page 288; "Canvey Island," facing page 289; two photographs of "The Alde at Slaughden," facing page 296; two of "Sutton-on-Sea," on the reverse side of the Alde pictures. Acknowledgement to the Air Ministry and to Crown Copyright in each of the above six cases is hereby made.

THE ROYAL GEOGRAPHICAL SOCIETY

KENSINGTON GORE, LONDON, S.W.7

FELLOWSHIP AND ASSOCIATE MEMBERSHIP

The object of the Society being the Promotion and Diffusion of Geographical Knowledge, it has always welcomed to its Fellowship those anxious to further this object by their interest and support, as well as those able to take a more active part in the work of discovery and exploration.

FELLOWSHIP

The Bye-Laws provide that a candidate for admission to the Fellowship of the Society must be proposed by a Fellow personally known to him and seconded by another Fellow. Further, that a candidate is not eligible until he (or she) is twenty-one years old, unless he holds a Commission in Her Majesty's Forces or he (or she) is a matriculated student of a University of the United Kingdom or the Self-Governing British Dominions. Proposal forms can be obtained on application to the Director and Secretary.

Every Fellow shall be required to pay on election *either* £4 as Entrance Fee and £4 as Annual Subscription for the current year and thereafter an Annual Subscription of £4 due on 1st January in each year; *or* a single compounding fee of £60.

The Entrance Fee and first Annual Subscription may be paid in four quarterly instalments of £2 each; *or* the Entrance Fee and first two Annual Subscriptions may be paid in four half-yearly instalments of £3 each. Thereafter the Annual Subscription may continue to be paid in four quarterly instalments of £1 each or two half-yearly instalments of £2 each respectively. Entrance Fee and Annual Subscription may be paid by instalments only where payment is made by Banker's Order. Half-yearly instalments shall be due on the 1st January and the 1st July; quarterly instalments shall be due on the 1st January, 1st April, 1st July and 1st October.

For Fellows who are under the age of 25 years on election the Entrance Fee shall be reduced from £4 to £2. The Entrance Fee and first Annual Subscription may be paid in four quarterly instalments of £1 10s. 0d. each *or* the Entrance Fee and first two Annual Subscriptions may be paid in four half-yearly instalments of £2 10s. 0d. each: thereafter payment may be by instalments as above. Entrance Fee and Annual Subscription may be paid by instalments only where payment is made by Banker's Order.

Fellows may compound for their Annual Subscriptions at any subsequent time by a payment of £60 less £2 for each Annual Subscription paid in excess of five with a minimum of £20 after 25 payments.

No Fellow shall be entitled to vote or to enjoy any privilege of the Society while in arrear.

ASSOCIATE MEMBERSHIP

The Bye-Laws covering the terms of Associate Membership provide that—

1. *A candidate must be not less than 17 and not more than 20 years of age. He (or she) must be recommended by a Fellow, University or School authority.*
2. *Subscription shall be £2 per annum without Entrance Fee.*
3. *On attaining the age of 21 Associate Members become eligible for Fellowship. The Entrance Fee of £2 shall be waived provided they have been Associate Members for 3 years. Otherwise Associate Membership shall cease at the age of 21.*

All subscriptions are payable in advance, on the 1st of January in each year.

PRIVILEGES OF FELLOWS AND ASSOCIATE MEMBERS

The privileges of a Fellow or Associate Member include admission (with one Friend) to all ordinary Meetings of the Society, and the use of the Society's House, Library and Map-room. Each Fellow is also entitled to receive a copy of *The Geographical Journal*. Associate Members have the choice of receiving either *The Geographical Journal* or *The Geographical Magazine*. Associate Members may not describe themselves as F.R.G.S. and have no vote at Annual or Special General Meetings.

A pamphlet giving details of the Society and a copy of the Charter and Bye-Laws will be sent on application to the Director and Secretary.

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